Electrical Contracting

SEPTEMBER
1944

a Magazine of
ELECTRICAL CONSTRUCTION AND MAINTENANCE



THIS ISSUE...Electrifying new streamlined steel plant at Geneva, Utah...What to do about stabilizing industrial voltages . . . More about figuring labor on conduit installation . . . How to electrify hand operated elevators . . . What's coming at the NECA meeting...Practical information on maintaining series lighting systems . . . Application data on wound rotor motors . . . and much useful "know-how" material.

2-WAY-LEAD BALLAST FITS ANY FIXTURE

NEW

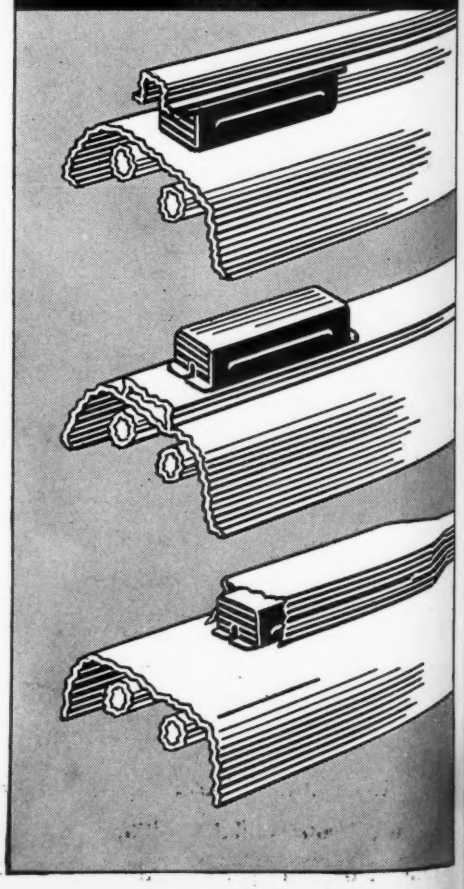


ANGLE SLOT
lets the leads out at ends or bottom

•

Eliminates need for two case styles in each rating

FOR EXPOSED OR ENCLOSED MOUNTING
on commercial or industrial fixtures



Ratings: 30-, 40-, and 100-watt Tulamp; 40-watt three lamp; 100-watt Forlamp; 40-watt, h-v Tulamp

THIS new ballast has all the mounting and application features of ballasts with leads out the end and ballasts with leads out the bottom. It can be applied (without fixture design changes) to present fluorescent-lighting fixtures, whether designed originally for either of the above types of ballast. (See three typical examples at right.)

Reduces ballast inventory: Because this new two-way-lead ballast is so universally applicable (permitting fixture manufacturers to meet diversified demands), it is necessary to stock only this one case style in the ratings for which it is designed. Thus, your stock inventories can be cut, and valuable warehouse space released.

Complete interchangeability: Provision has been retained for either center or corner-hole mounting, and all dimensions and electrical characteristics are identical to those of the ratings that are superseded, making this new ballast interchangeable in every respect with the superseded ratings. Ask for Supplement 3 to GEA-3293E. *General Electric, Schenectady 5, N. Y.*

BALLASTS FOR FLUORESCENT LIGHTING

GENERAL ELECTRIC

408-24-5205

"A FIRST CLASS INSTALLATION", *say electricians*

(*and they also say,* "SO EASY TO PUT IN")



Arc-quenching construction in 2, 3 and 4 Pole, 30, 60 and 100 Ampere Safety Switches.

SKETCHED above is the switch block from a Murray Single Throw, Fusible, Type D, Safety Switch. In the circle is the outstanding feature — the double break blade and arc quenching chamber.

Each blade is provided with a double break — the arc is broken into two parts. The burning is greatly reduced by this feature. Whatever arc is formed at each of the two breaks is drawn into a narrow slot in the mounting base where it is lengthened-out and cooled — the effects co-acting to quench the arc almost instantly.

This arc-quenching construction coupled with those Murray Switch characteristics as ample wiring room, properly placed knockouts, good-looking cabinets, assure the electrician the satisfaction that comes from a first-class installation. Metropolitan Device Corporation, Brooklyn, New York.

Write for the facts — no obligation!

Murray

SAFETY SWITCHES

THERE ARE MURRAY JOBBERS EVERYWHERE

Keep On

BUYING WAR BONDS AND STAMPS

ELECTRICAL CONTRACTING. Published monthly, price 25 cents a copy. Vol. 43, No. 9. Allow at least ten days for change of address. RETURN POSTAGE GUARANTEED. Publication Office, 99-129 N. Broadway, Albany, N. Y. All communications about subscriptions should be addressed to the Director of Circulation, Electrical Contracting, 330 West 42nd St., New York 18, N. Y. Subscription Rates—U. S. A. and Latin American Republics, $2.00 a year, $3.00 for two years, $4.00 for three years. Canada $2.50 a year, $4.00 for two years, $5.00 for three years. Great Britain and British Possessions, 18 shillings for one year, 36 shillings for three years. All other countries $3.00 a year, $6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. Copyright 1944 by McGraw-Hill Publishing Company. Cable address: "McGraw-Hill, New York." Member A. B. P. Member A. B. C.

JOBS RUN SMOOTHER WITH APPLETON "UNILETS"

REG. U. S. PAT. OFF.

You Save Time and Energy..

Because:

1. Appleton engineering skill provides superior design and workmanship.
2. The Appleton Line is Complete—a fitting for every purpose.
3. Appleton service is prompt and dependable.



Form 35 Appleton "Unilet", Threaded Type, for use with Rigid Conduit (Heavy-wall).

Form 35 Appleton "Unilet". Perfect alignment and precision finish make installation quicker and improve workmanship all around.



Form 35 Appleton "Unilet", No-Thread Type,—for use with Rigid Conduit (Heavy-wall); also made for Electrical Metallic Tubing.

Tougher, Stronger..

MADE OF MALLEABLE IRON

Batter, bend or *twist* an *Appleton "Unilet."* It won't break because it is MALLEABLE IRON—light but tough—made to precise specifications in Appleton's own foundries, and free from holes, blemishes and gating marks.

Inspect an Appleton "Unilet". You'll find roomy wiring space and latest, most improved design. Form 35 "Unilets" illustrated above are typical. Notice the absence of ear lugs on the bodies; the chamfered edges on the conduit hubs.

Benefit from Completeness of the Appleton Line. Over 15,000 distinct types and sizes of fittings and fixtures. Illustrated and described in the big Appleton catalog.

Install Appleton "Unilets" on every job to run jobs smoother and save time and energy. Appleton "Unilets" are standard for better wiring.

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY

1704 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

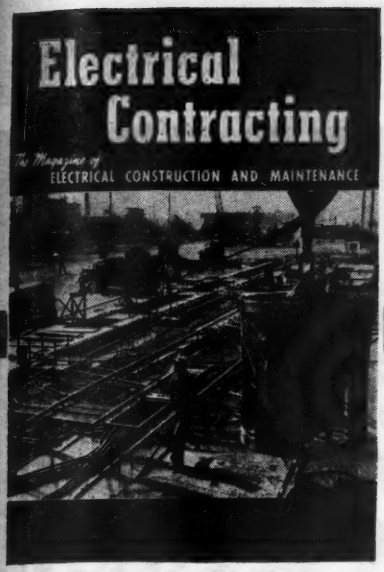
Branch Offices: NEW YORK, 76 Ninth Avenue • DETROIT, 7310 Woodward Avenue • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna Street • ST LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 175 Luckie Street, N. W. • BIRMINGHAM, 6 N. Twenty-first Street • MINNEAPOLIS, 305 Fifth Street, S. • PITTSBURGH, 418 Bessemer Bldg.

Resident Representatives: Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle.

APPLETON ELECTRIC PRODUCTS REG. U.S. PAT. OFF.

APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES



OUR COVER—Pouring slab over conduit maze at the Geneva Steel job. Story on page 43.

W. T. Stuart.....Editor
Alice McMullen.....Associate Editor
August Eckel....Middle West Editor
R. E. Miller.....Industrial Editor
W. A. Cyr.....Pacific Coast Editor
H. W. Young.....Southwest Editor
Harry Phillips.....Art Editor
W. K. Beard, Jr.....Publisher
M. S. MacNaught..Manager

DISTRICT MANAGERS

S. A. Jones.....New York
F. J. Seiler.....Cleveland
W. B. Heaps.....Chicago
A. B. Conklin, Jr.....On leave U. S. Army

●

McGRAW-HILL PUBLISHING COMPANY, INC.
JAMES H. McGRAW, Founder and Honorary Chairman; JAMES H. McGRAW, Jr., President; HOWARD EHRLICH, Executive Vice-President for Business Operations; JOHN ABBINK, Executive Vice-President for Editorial Operations; CURTIS W. McGRAW, Vice-President and Treasurer; JOSEPH A. GERARDI, Secretary; J. E. BLACKBURN, Jr., Director of Circulation. Publication Office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive Offices, 330 W. 42nd St., New York 18, N. Y. *Branch Offices:* 520 North Michigan Ave., Chicago 11; 68 Post St., San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia 2; Cleveland 15; Detroit 2; St. Louis 8; Boston 16; Atlanta 3; Los Angeles 13; Pittsburgh 22. Member A.B.C. Member A.B.P.

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management in the field of electrical construction and maintenance.

Electrical Contracting

Contents for SEPTEMBER, 1944

For Better Wiring—*An Editorial* 41

Wiring for Steel 43
By W. A. CYR—High voltage loop distribution, intricate cable and bus installation and extensive floodlighting are some of the features of this huge steel plant at Geneva, Utah.

Estimating Conduit Work—Part 2 48
By LEO W. WITZ—In this second article pan, tile arch and exposed work are reviewed.

NECA to Meet in French Lick 53
A word about the program of the 43d Annual Meeting scheduled for October 1 to 5.

Outdoor Series Lighting 54
By E. B. KARNS—This article discusses the circuit, its apparatus and its care and maintenance of outdoor series lighting.

Motorizing Hand Elevators 58
How a San Antonio motor shop solved the materials handling manpower problem in small food processing plants by supplanting old elevator hand ropes with V-belt electric motor drives.

Voltage Improvement Methods 60
By W. C. BLOOMQUIST—Various corrective measures can be easily applied to remedy any poor voltage condition existing in industrial plants.

Windings in Chinese 63
Photos from the Chinese News Service give a glimpse of how modern China handles motor winding jobs.

Editorials 64

Industrial Electrification 81
Selection and Application of Wound Rotor Motors—II

Departments

Practical Methods..... 66
Motor Shops 74
Data Sheets 84
Reader's Quiz 92
Modern Lighting 104
Questions on the Code..114
Equipment News 120
Electronics 126
In the News.....138
Manufactrers' News.....160
Advertisers' Index 174

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*

Economical of Space

THIS graceful, fan-like conduit installation will delight the eye of any electrical contractor. More important still, it is evidence of one contractor's skill and ability to economize on space. Note also that for maximum efficiency and to facilitate the insertion of wiring, the conduit has no sharp bends.

Youngstown's BUCKEYE CONDUIT is easy to handle and install. In the hands of experienced men, it can be compactly installed within normal walls and floors, so that it requires no extra space. Hidden from sight it still provides a quick, safe method for enlarging or changing wiring systems at any future time.

Plan now to install Youngstown BUCKEYE conduit in your postwar buildings, as well as for permanently replacing wartime wiring. This full weight, standard-threaded, rigid conduit gives complete and permanent protection to wiring against damage from moisture, vibration, dust, dirt, or crushing.

Just as soon as wartime restrictions permit, BUCKEYE CONDUIT will be available at all distributors.

BUCKEYE TRADE MARK YOUNGSTOWN CONDUIT



YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

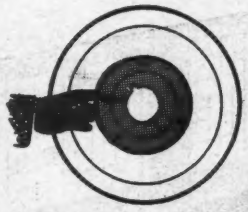
YOUNGSTOWN, OHIO

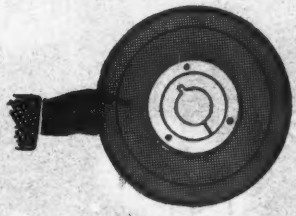
Manufacturers of

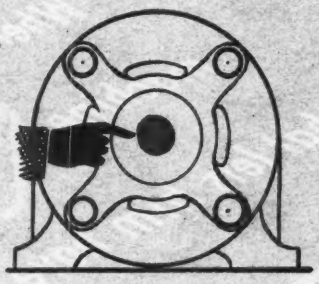
CARBON - ALLOY AND YOLOY STEELS

Ask your distributor for: Youngstown Buckeye Conduit...Pipe and Tubular Products...Sheets...Plates...Electrolytic Tin Plate...Coke Tin Plate...Bars...Rods...Wire...Nails...Tie Plates and Spikes.

This locks this to this in 1 quick operation







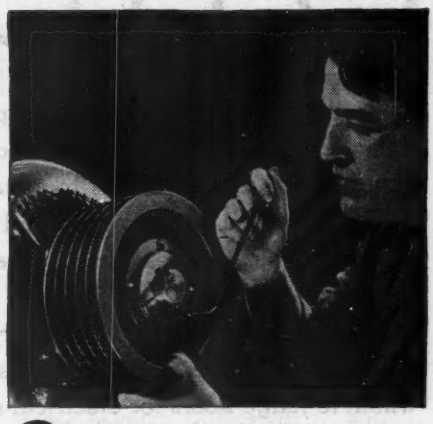
Allis-Chalmers' new "Magic-Grip" with tapered split bushing is put on, aligned, locked to shaft *as a unit* — making it the fastest mounting and demounting sheave on the market!



1 Place sheave on shaft. Slides on smoothly because clearance is provided by expanded bushing. There's *no* hammering — *no* forcing! Complete sheave and bushing unit comes intact—ready for quick, easy mounting.



2 Slide to desired position. Sliding easily, sheave can be placed *exactly* according to straight-edge . . . giving you true alignment with resulting smooth performance. A minimum of time is required.

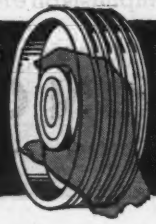


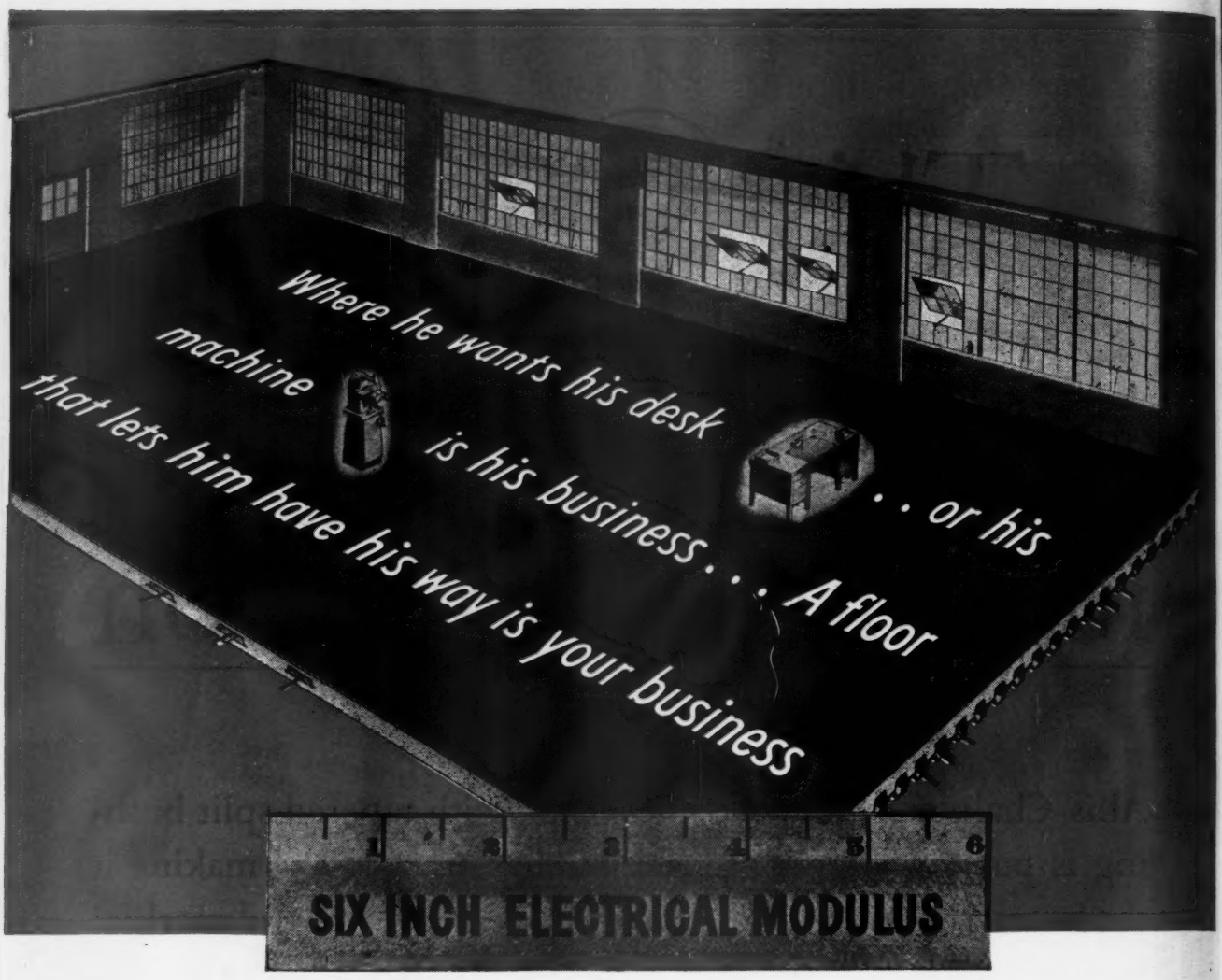
3 Tighten three capscrews — and it's ready to go! Entire sheave is locked securely to shaft and *grips like magic!* No set screws to damage shaft. Send for Bulletin B6310. Allis-Chalmers, Milwaukee 1, Wis.

A 1757

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES





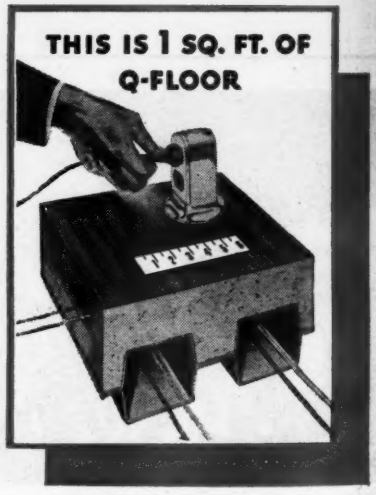
Q-FLOORS

Q-Floors are your business. They promote the greater use of electricity and stimulate the sale of electrical fittings.

No user of a floor knows in advance where he will want all his outlets. He must change his mind as working conditions change. A Q-Floor encourages him to change his outlets as often as he changes his mind.

Q-Floor construction makes every six-inch area of the floor alive with electrical availability. This is the new six-inch modulus by which to judge floors for electrical serviceability. The tenant merely calls an electrician who installs an outlet exactly where it ought to be. This fosters the use of more electrical equipment. It facilitates the rearranging of equipment. Instead of avoiding changes, owners use the electrical availability of Q-Floors as a rental argument.

Any building with Q-Floors puts the emphasis on *electrical service.*



Electrical Fittings **for use with Robertson Q-Floors are sold through General Electric construction materials distributors. For information about these fittings—and how they can be used to obtain adequate up-to-date electrical wiring—get in touch with the nearest G. E. Merchandise Distributor. H. H. Robertson Co., 2401 Farmers Bank Building, Pittsburgh 22, Pa.**

H. H. ROBERTSON COMPANY
2400 FARMERS BANK BUILDING • PITTSBURGH, PA.



Bz-z-z.. off goes Trouble!

A SOLID STRUCTURE such as a motor shaft rarely fails from the inside out—it fails from the outside in. Moral: get rid of every surface tool mark or irregularity that might someday invite cleavage.

That's what Stan Brothers, above, of Allis-Chalmers Norwood Works is doing. As he painstakingly polishes the shaft—back and forth, back and forth—he works down to a finish that's slicker than silk.

Why does he follow his job so intently? Because in 17 years at Allis-Chalmers Stan has learned that he and every other employe has a *personal* stake in every motor.

He knows that when he helps build a *great* motor for you he helps make a *friend* . . . and that friends are something no company and its workers can have too many of.

Actually, it was friends that put Allis-Chalmers importantly in the motor business in the first place.

Years ago, Allis-Chalmers began building motors only because it wanted, to put on heavy-duty equipment it built, better motors than it could buy. Then a few of those motors were sold separately to one customer, a few to others . . .

And the reputation those motors earned—"You can depend on Allis-Chalmers Motors"—literally forced Allis-Chalmers into building electric motors in volume for the market!

So the very existence of Norwood Works is proof and reminder to every Allis-Chalmers coil winder, machinist, inspector, welder, brazer, painter, assembler—that *good work catches up with a company just as surely as bad work.*

That's why you can expect *good* work in every Allis-Chalmers motor! Allis-Chalmers, Milwaukee 1, Wis.

A 1728



YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS



FRINK-built frames help army radios over the rough spots

Radio apparatus going forward with the U. S. Army must travel over some mighty rough terrain. Trucks equipped with transmitters and receiving sets are provided with special frames to which the radio instruments are attached. Thus these delicate pieces of machinery are held stationary and are protected against the banging and bumping of uneven ground.

Many of the sturdy radio frames used in U. S. Army trucks are made by Frink. The Frink Corporation has specialized in precision engineering and manufacturing for 87 years. During that time the name Frink has become synonymous with quality and skill in the lighting industry.

Frink was instrumental in developing Incandescent lighting in the days when that method of illumination was considered revolutionary. Likewise The Frink Corporation has pioneered in the development of Fluorescent lighting. LINOLITE, the famous "engineered for vision" Fluorescent equipment, is a product of Frink designing and manufacturing skill. LINOLITE is now giving efficient and profitable service in many of America's foremost factories, stores and banks.

Today Frink is heavily engaged in war production. Tomorrow Frink will resume the designing and manufacturing of the high-quality lighting equipment that has gained such an enviable reputation in the industry.

LIGHTING SINCE 1857

THE FRINK CORPORATION
BRIDGE PLAZA NORTH
LONG ISLAND CITY 1, N.Y.

Subsidiaries: Sterling Bronze Company, Inc.
Barkon-Frink Tube Lighting Corporation

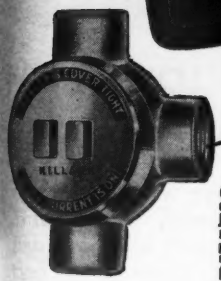
★ ★ ★ ***All Frink employees invest at least 10% of their earnings in War Bonds*** ★ ★ ★

WE ARE PROUD OF THAT RECORD. LET'S ALL BUY WAR BONDS!

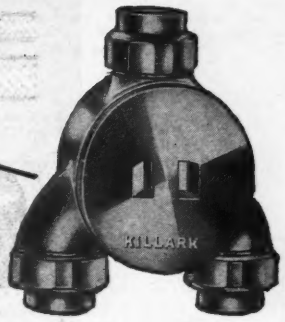
THE SAFE LINE



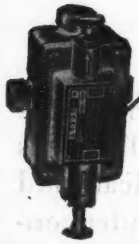
KILLARK
ST. LOUIS



GEMT Round Fitting (2⅛" dia. x 1⅞") for hazardous junctions. Screw cover. Cadmium plated, tough Killark processed iron. Supplied with ½" or ¾" standard threaded hubs, five accurate threads on each.



GEUEA Round Fitting (3" dia. x 2½") with union hubs, each with ½" or ¾" interchangeable threaded rings. Accurately threaded cover. Cadmium plated, heat treated iron.

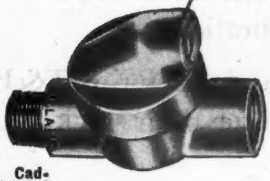


XOT—Totally inclosed Motor Starting Switch, single or double pole, with mounting lugs. Contains interchangeable heating unit. (3" x 4⅝" x 3¾".) ½" or ¾" conduit hubs.

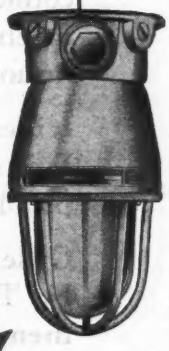
ELXG Ceiling Light with guard. Explosion resistant. Sturdy steel construction with heat resistant glass. Sealed splice chamber. Unscrewing guard assembly permits easy bulb replacement. Sizes for 100 W to 500 W bulbs.



EKK Flexible Coupling for hazardous, confined connections. Sturdy, braided steel sheathing with accurately fitted nipples, male at one end, female union at the other. Sizes from ½" dia. 8¼" long to 2" dia. 41⅝" long.



EYS Sealing Fitting. Cadmium plated heat treated iron. Installed with Killark sealing compound and asbestos dams to prevent arcing, flame or sparking at motor, electronic heating and switch terminals.





T—Junction Box, with wall or ceiling lugs, for explosion-proof light suspension. Cover secured by four lock-washered screws with set screw to prevent pendant unscrewing. (JLT. 3¼ Sq. x 2½"—JALT 4⅝" Sq. x 3⅛"

Killark

Ask Your Electric Wholesaler, or Write Us, for Information About the Complete Killark Line.

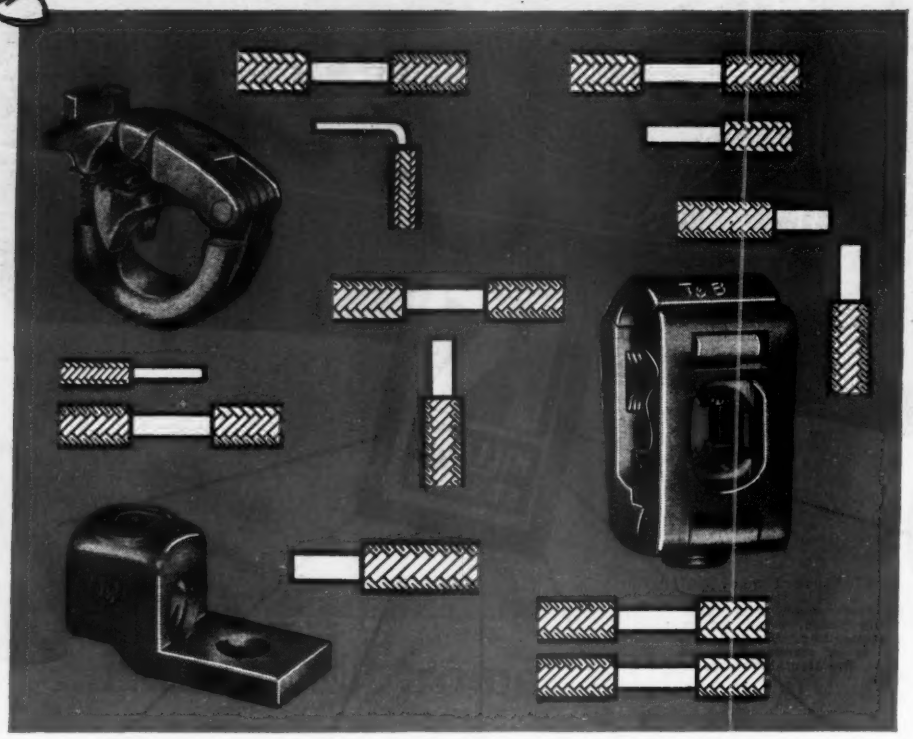
KILLARK
ST. LOUIS

BRANCHES: *Offices and Warehouses:* Atlanta, Baltimore, Boston, Chicago, Denver, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, Utica.
Offices: Cincinnati, Cleveland, Dallas, Detroit, Kansas City, Minneapolis.

Vandeventer & Easton Aves.
SAINT LOUIS 13, MO.



WHY NOT *SIMPLIFY* ALL YOUR HOOK-UPS WITH THESE FEW T&B LOCK-TITE PRESSURE (*Solderless*) CONNECTORS



A SMALL assortment—a handful—of these Approved T&B Lock-Tite Pressure Connectors will take care of practically all the lugging and tapping you are ever likely to do.

Each connector takes several overlapping cable sizes up to 1000 MCM, and handles any type; solid, stranded, flexible, extra-flexible, hemp-core, rod or tubing.

Being salvageable, T&B Lock-Tites can be used over and over again.

Being solderless, the electrician on the job finds them simple to install. He is confident of a perfect electrical and mechanical connection, even under continuous vibration.

It is easy to see how this T&B Lock-Tite Line simplifies your stock and inventory problems.

Ordering them is simple, too. Your near-by T&B Electrical Wholesaler carries them in stock.

Write Dept. EC-8 for Maintenance and Repair Booklet giving all the dope on this Lock-Tite Line.

T&B

THE THOMAS & BETTS CO.
INCORPORATED
manufacturers of electrical fittings since 1899
ELIZABETH, N. J., NEW JERSEY
In Canada: Thomas & Betts Ltd. Montreal



Seven-year Burial proves superiority of FLAMENOL INSULATED CABLE





After seven years in series-lighting service, buried directly in the ground, this two-conductor, concentric No. 8 Flamenol cable is still as good as new.

FLAMENOL'S LASTING PROPERTIES GIVE LONG, ECONOMICAL SERVICE UNDER SEVERE OPERATING CONDITIONS

More than six years before Pearl Harbor, an Eastern power company made a direct-burial installation of Flamenol cable. After seven years' service, part of it was removed and the insulation was tested—with these results:

Physical Condition: *Excellent*

Insulation Resistance: *336 megohms per 1000 ft*

Tensile Strength: *2560 lb per sq in.*

Elongation: *220 per cent*

Many thousands of feet of Flamenol have since been installed underground for series lighting and 600-volt power circuits. Tests after varied lengths of service show that physical and electrical characteristics of the insulation remain practically unchanged.

Specially developed for severe operating conditions

Years before any rubber shortage, G-E engineers turned to synthetic resins for improved cable insulation. Flamenol, the first such cable to be utilized commercially, proved vastly superior to rubber-insulated cable for service under adverse conditions.

Today, after years of constant development, Flamenol cable offers a wide range of operating advantages:

FLAME RESISTANCE

Does not support combustion.

CORROSION RESISTANCE

Immune to action of oils, acids, alkalies.

AGING

Does not oxidize. Highly resistant to sunlight and weathering.

PHYSICAL PROPERTIES

Tensile strength, 1500 lb per sq in., minimum. Elongation, 100 per cent, minimum.

DIELECTRIC STRENGTH

720 volts per mil, retained through severe operating conditions.

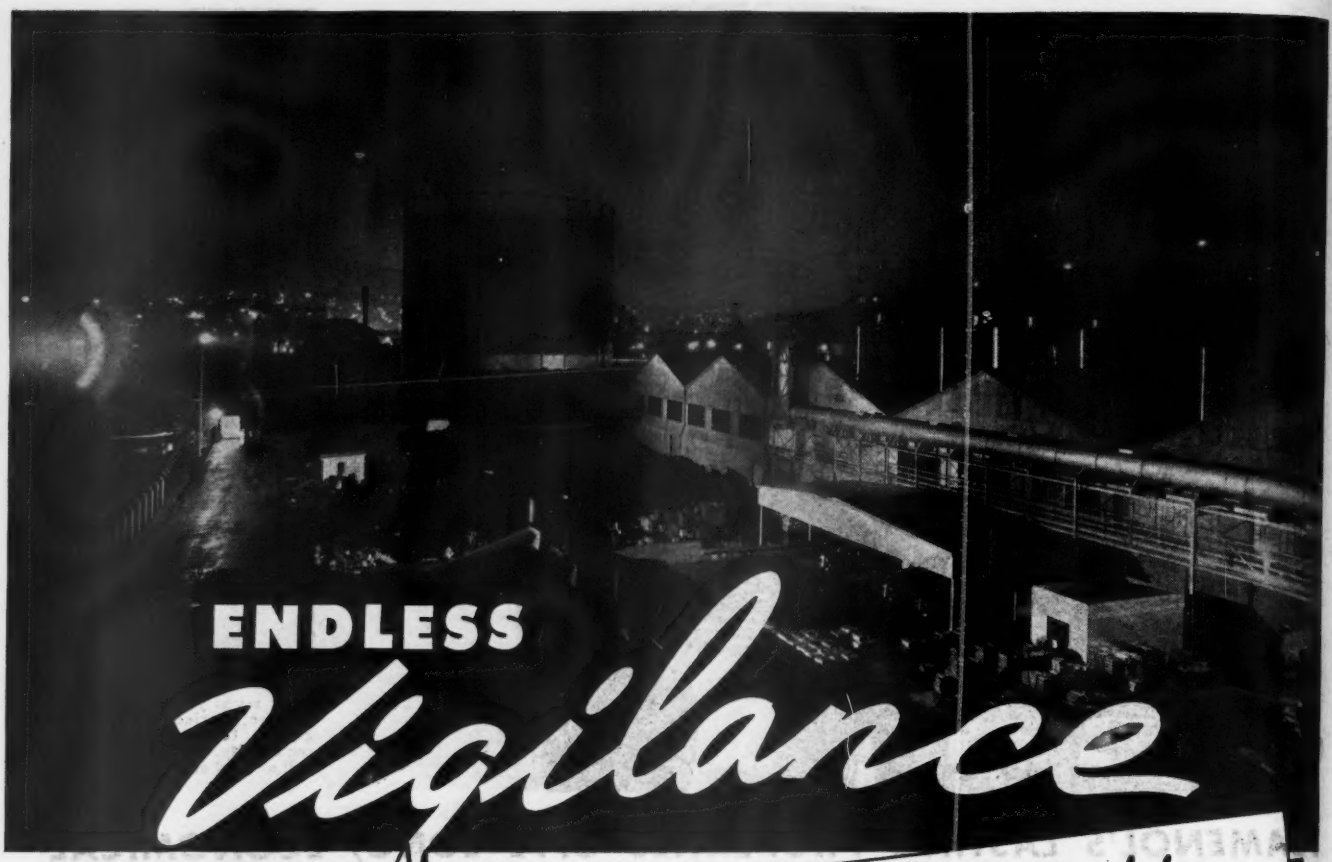
In addition to these *time-proved* operating advantages, Flamenol cable is easy and economical to install and maintain. That's why millions of feet of this long-lived cable are used for power and lighting circuits in the chemical, food, textile, printing, oil, mining, steel, automotive, railroad, and other industries. For detailed information on uses, constructions, sizes, etc., write for Leaflet GEA-2733D. *General Electric Company, Schenectady, N. Y.*

7 Extras That Insure EASY INSTALLATION, ECONOMICAL MAINTENANCE

1. SMALL DIAMETER saves space, facilitates wiring.
2. SMOOTH SURFACE assures easy pulling.
3. FREE STRIPPING speeds splicing, avoids nicking conductors.
4. DIFFERENT COLORS simplify circuit tracing.
5. VARIOUS CONSTRUCTIONS to suit special applications.
6. SELF-PROTECTING finish eliminates need for conduit.
7. RETAINS ATTRACTIVENESS makes re-painting unnecessary.

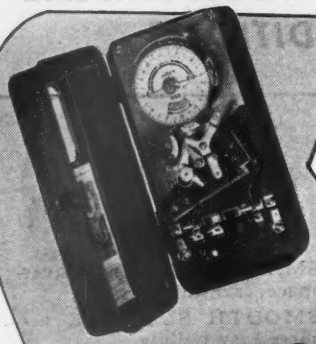


GENERAL ELECTRIC



ENDLESS *Vigilance*

WHERE THERE IS A NEED FOR *Floodlighting*
THERE IS A SALE FOR *Automatic Control*



SANGAMO TIME SWITCHES

• There are types to meet every protective lighting control need. The complete line includes Astronomic Dial, Synchronous Carry-Over, and Outdoor Time Switches. Form VSW2 Astronomic Dial Time Switch is shown above. Current interruptions up to 10 hours will not stop it nor affect its "on" and "off" settings.

THERE is no end to the floodlighting protection given by SANGAMO TIME SWITCHES—no end until the time set for lights off. The user simply sets this floodlighting guard for the time the lights are to go on and off—his worries end there. He knows that he is getting the full floodlighting protection he is paying for.

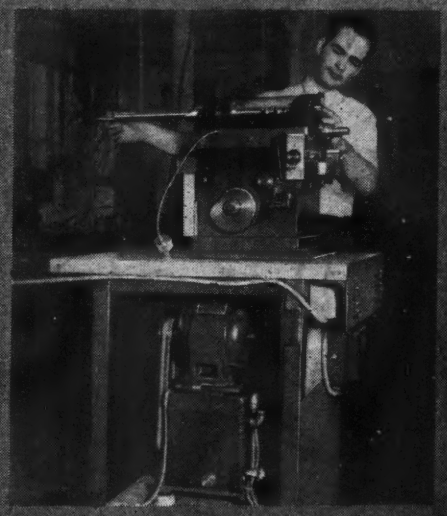
To you it means added sales—buyers of floodlighting can't help seeing the great protective value of SANGAMO TIME SWITCHES. Users of floodlighting who haven't this protection are immediate prospects.

Write for catalog.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

CAN'T QUIVER

Motors driving precision machines can't quiver without affecting the work, particularly when the motor is mounted directly on the machine. The close tolerances required on so much vital war equipment have intensified the need for machines and motors that remain smooth-running, month after month, in three-shift service. Why have G-E Tri-Clad motors gone on—and stayed on—so many high-precision machines? Our test procedure for balance and vibration is an important part of the answer.



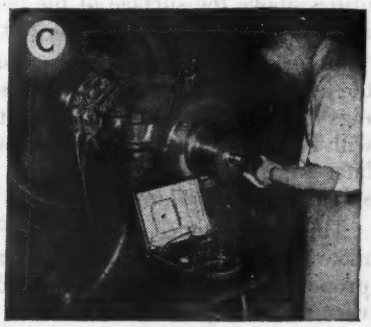
High-precision recessing machine in Waltham Watch Company plant, driven by G-E Tri-Clad motor

G.E.'s vibration tests and balancing procedure help make TRI CLAD motors smooth-running and quiet

Unmatched experience in making vibration studies, especially our work on high-speed turbines, helped us to perfect dynamic-balance techniques and devices that give assurance of smooth-running motors. Every Tri-Clad rotor is dynamically balanced, and in addition, spot-checks of assembled motors are made: (A) making an electronic dynamic-balance test on Tri-Clad rotors; (B) spot-check with G-E vibration indicator, with motors on elastic mountings; (C) portable electromagnetic tester being used on large motor. This test can also be applied to a motor installation, if desired. *General Electric Company, Schenectady 5, New York.*







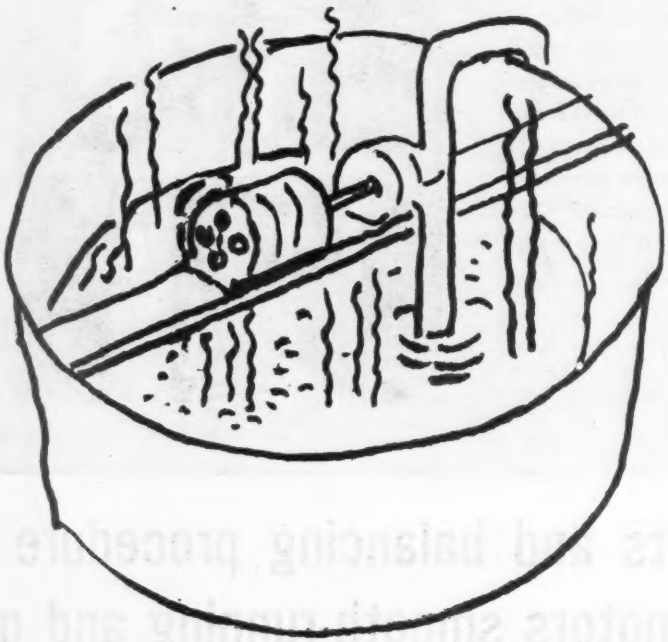
GENERAL ELECTRIC

TRI CLAD MOTORS

Buy all the BONDS you can—*and keep all you buy*

A FIBERGLAS* CASE HISTORY

MOTOR NOW RUNS MONTHS IN 250° F. AMBIENT TEMPERATURE



Averaged only 2 weeks before FIBERGLAS Insulation was adopted

A nationally known die-casting company was confronted with this problem: its metal-melting tanks required motors to drive pumps located directly above the tanks. These motors were installed 18 inches above the surface of the molten metal, in an ambient temperature of about 250° F.

Motors wound with organic insulation lasted, on the average, only about two weeks before the windings failed. As a solution, these motors were rewound with Fiberglas inorganic insulation—and six months later were still giving continuous service *without a single winding failure!*

This performance is typical of Fiberglas-insulated motors—but is only one of the advantages. When properly applied and impregnated with the correct varnish, Fiberglas insulation also gives exceptional performance in conditions of severe moisture, acid and vibration.

What is Fiberglas?

Fiberglas electrical insulation is made from strong, fine glass fibers which are twisted into yarns, wound on wires, woven into tapes and cloths, braided into sleevings and formed into cords and other forms required for motor insulation. As a rule, Fiberglas insulation occupies no more space inside the motor than organic tapes, and much less space than equivalent inorganic materials. And, because Fiberglas does not deteriorate with age, it is the ideal insulation for stand-by motors—even though an organic insulation seems sufficient from an operational point of view.

Ask your motor manufacturer about Fiberglas-insulated motors. Or, if you are having motor failures, ask your repair shop to use Fiberglas on your next rewind job.

Fiberglas electrical insulations are immediately available. For complete information, consult your distributor or write *Owens-Corning Fiberglas Corporation, 1856 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

FIBERGLAS* **ELECTRICAL INSULATIONS**

*T. M. Reg. U. S. Pat. Off.

ARMY E NAVY

YARNS • TAPES • CORD • SLEEVING • CLOTH AND OTHER FORMS



From core to cover—it's a quality friction tape!



Also superior are Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

The extra care Jenkins takes to wrap every *roll* of Gold Seal Tape in cellophane – instead of simply wrapping the box – is typical of the quality, skill and careful control that go into the manufacture of this fine product.

You find this same superiority also in Gold Seal's greater tackiness – it's readiness to take hold of any taping job with a vengeance, and stick to it like a burr on a dog's back. You'll like the way this tape doesn't "peel" when it comes off the roll, doesn't dry out on the shelf or on the job. And doesn't smear up one's hands, even when it's used in the warmest weather!

Yes, you'll get a new respect for tape when you try Jenkins Gold Seal! Your regular distributor probably carries it, so ask for it next time you tackle a tough taping job. Jenkins Bros., 80 White St., New York 13, N. Y.

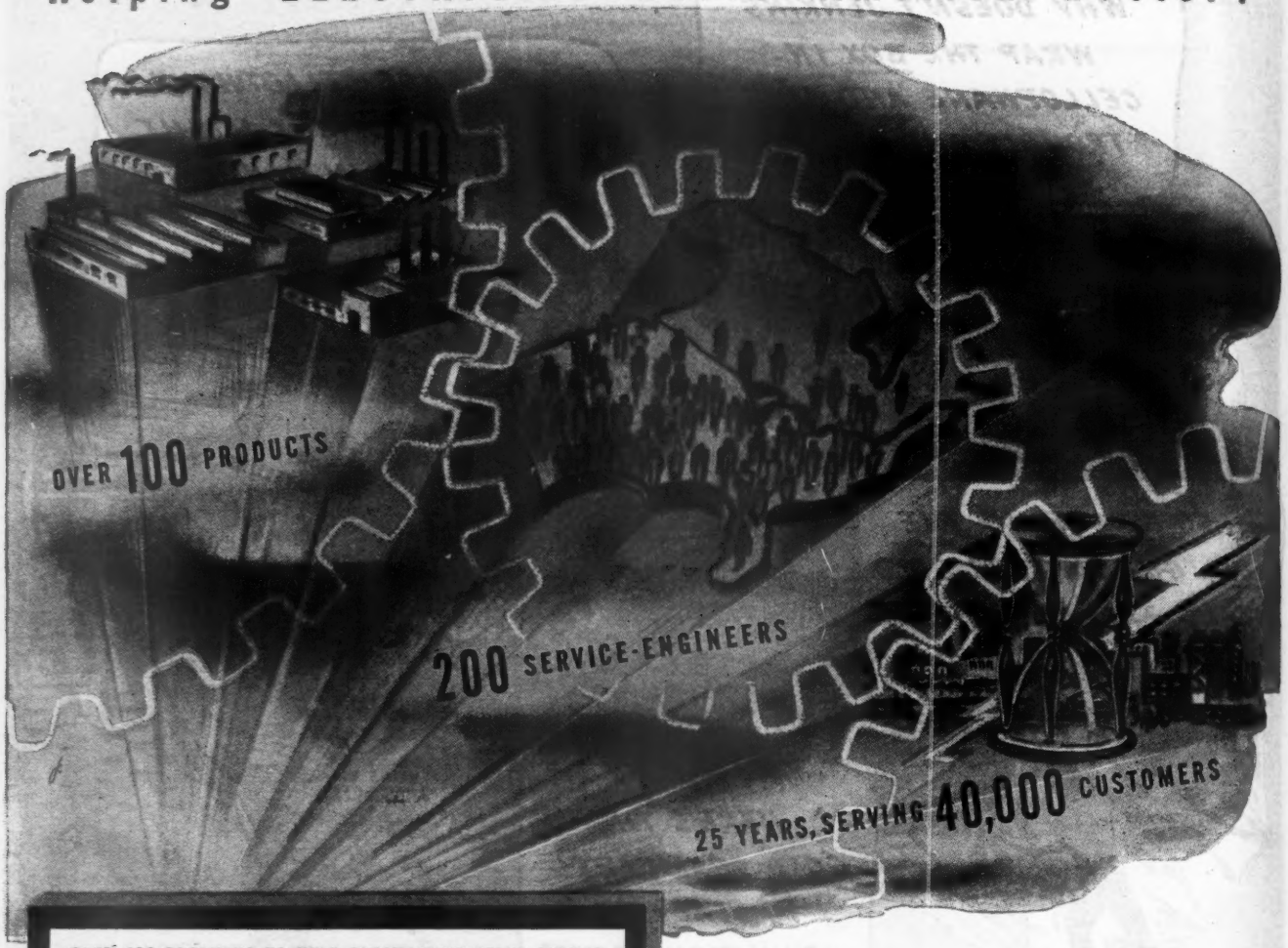
JENKINS TRADE JENKINS MARK Jenkins Bros

Gold Seal Tapes

FRICTION and RUBBER TAPES

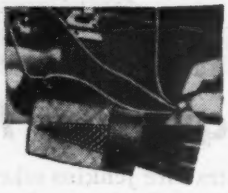
MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

Helping ELECTRICITY serve America better!



OVER 100 PRODUCTS TO HELP ELECTRICITY SERVE BETTER

IDEAL "WIRE-NUTS" (Solderless, Tapeless Wire Connectors) are recognized as Standard throughout the Electrical Industry for Building Wiring, Industrial Plant Wiring, Joints in Electrical Equipment, etc. Proved to be most practical, lowest priced—and best joint, electrically and mechanically.





IDEAL RESISTANCE SOLDERING TOOLS have revolutionized soldering. A complete line of specialized tools for a wide variety of difficult soldering jobs. Instant Controlled Heat.

IDEAL Wiring Devices. Peace-Time or War-Time, wiring jobs must be finished fast in industrial plants and in construction. That is why each year more millions of these IDEAL Wiring Devices are used:—

- IDEAL "Wire-Nuts"
- Lugs, Solder and Solderless
- Fish Tape, Reels and Pullers
- "E-Z" Wire Stripper (illustrated)



SOLD THROUGH JOBBERS

Other IDEAL Products include Motor Maintenance and Repair Equipment, Industrial Cleaners, Electric Marking Tools, Machine Tool Accessories, Wiring and Fuse Devices, Safety Tools and Equipment.

When war came to America . . . Industry found IDEAL ready . . . a dependable source of supply for over ***100 products*** urgently needed then as now to meet and maintain production schedules. Over ***200*** IDEAL ***Service Engineers*** from Maine to California then, as now, were available to answer calls from ***40,000 customers*** for more and more of the kind of equipment and supplies which IDEAL had developed in over a ***quarter of a century***, specializing in Making Electricity Serve America Better.

Whether you're figuring on the needs of Today or Tomorrow . . . your IDEAL Service Engineer *awaits your call* . . . his knowledge of tools and devices which speed production and cut costs is at your service.

IDEAL'S warehouse stocks at plant and in all principal cities and in wholesalers' storerooms assure you of best possible service. A free copy of the IDEAL Handbook illustrating and describing IDEAL Products is yours on request.

IDEAL *Sycamore*

IDEAL COMMUTATOR DIVISION, DRESSER COMPANY
1041 Park Avenue ★ Sycamore, Illinois

The *Stake* of the United States in Expanding World Trade

WITH the war in Europe racing to a climax, and with a sure pattern for the defeat of Japan already outlined, American business is confronted with the need for an immediate decision on long-term economic policy.

What is this country's foreign trade program to be after the war?

No intelligent appraisal of all the factors any longer can allow us to postpone considering the issue merely because, in the past, foreign trade absorbed barely eight per cent of our production.

Actually, a whole new set of conditions was injected into the picture by the first World War; but we persisted in ignoring these new factors.

Almost overnight, the United States was transformed from the largest debtor nation in the world to the second largest creditor nation. At the same time, we made faster technological progress than any other nation. Thus we created the need for more dollar exchange on the part of the rest of the world and simultaneously made it harder for other nations to earn dollars.

Today, as another, far vaster war is approaching its end, those changed circumstances are magnified. America has new responsibilities—to itself, and to the world.

Our war-inflated industrial capacity cannot be allowed to drop back to prewar levels without causing a domestic crisis which we dare not permit.

And, because so much of the world is geared to the American industrial machine, we can no longer contemplate calmly the repercussions of a largely self-sufficient trade program or of an unplanned foreign trade program. Either would inevitably set the stage for the next world war.

☆ ☆ ☆

If we are going to prepare ourselves intelligently to cope with this new problem, we must acknowledge certain basic principles.

World trade cannot be rebuilt simply by attempting to restore *prewar* flows of goods. The war has so completely changed the economic fiber of many countries that it is necessary to develop *new* trade relationships. The East Indies, for example, may find the demand for their rubber considerably reduced; the United States may, to a large extent, have to cease exporting cotton; Japan will need to find new substitutes for much of its exports of silk; the British will need new markets to replace the income which they formerly derived from their large overseas investments.

We cannot expand markets for our goods, at home or abroad, unless we find ways of buying more supplies from more people at home or abroad, so that they will have more dollars to spend.

And we probably cannot create increasing buying power abroad without first exporting more of our technical skills—our engineers, our production and management men—to build new markets for our own specialties.

☆ ☆ ☆

What is needed to rebuild the world's economic system?

1. Most basic of all, of course, are stable governments which command popular support. In the absence of strong governments, currency stability cannot be achieved.

2. Most war-stricken countries, for a year or two, will need rehabilitation loans, because they will require far more raw materials, equipment, and live stock than they can pay for out of current production.

3. Loans, however, are only a stop-gap, though often a necessary one. Far more important than rehabilitation loans will be the creation of better opportunities for war-stricken countries to sell to the rest of the world, particularly to the United States, South America, South Africa, and India. The ravages of war do not completely destroy the ability of a country to sell. Indeed, it is surprising what large supplies of certain commodities war-torn countries have on hand even before devastated industries have been restored. The invading troops in Normandy found shoes almost non-existent, but they found food more plentiful than in Britain.

   Better opportunities for war-stricken countries to sell would create opportunities for them to buy the things they will require to restore scattered industries and depleted farms, and would help those countries to get rid of the exchange controls which are now universal. So long as a country is able to expand its exports only slowly and painfully, and is dependent upon foreign loans to prevent the depreciation of its currency, so long will it carefully preserve exchange controls and other restrictions in imports. That is why large advances, either through an International Monetary Fund or an International Investment Bank, can make only limited contribution to the removal of trade restrictions.

4. Permanent monetary and credit arrangements are needed to protect nations against temporary pressure upon their currencies, to permit necessary changes in exchange rates to be made in an orderly manner, and to assure that governments never again will repeat the "beggar-my-neighbor" policies of 1931 and 1932.

5. Finally, the world needs a reversal of the trend toward economic self-sufficiency, which received a strong impetus from the first World War and an even stronger one from the great depression of the Thirties. This does not mean that the efforts of many raw-material producing countries to diversify their industries should be opposed. During the late Nineteenth Century and the first part of

this century, the international specialization of production was carried too far, with the result that many countries became dependent for a large part of their standard of living upon the export of one or two raw materials—coffee, sugar, rubber, silk, wheat, wool, and meat. Between the two World Wars, however, the pendulum swung much too far in the direction of self-sufficiency. Some densely populated industrial countries of Europe (Italy, France, and Germany) even attempted to become self-sufficient in wheat, fats, and sugar. So limited are the natural resources and technical skills of most countries that each one finds many things which it can produce only at prohibitive costs. Between the extreme specialization of the late Nineteenth Century and the more recent trend toward extreme self-sufficiency, a happy medium should be sought.

☆ ☆ ☆

What role should the United States play in reconstructing the world's international economic system?

There are those who suggest that the United States be a more or less permanent Santa Claus. They believe that an excess of exports could be financed only by "loans"—loans that would eventually turn into gifts, after producing bitter controversy over why the "debtor" country did not meet its obligations. The persons who assert that full employment can be provided only by an excess of exports are in effect saying that our economy cannot become self-supporting. That is a confession of economic defeatism which a young and vigorous nation should not be willing to make.

The most immediate contribution which the United States can make to world reconstruction is to make itself prosperous.

Prosperity here means a large demand by our industries for imports. The more we import, the easier will it be for foreign countries to meet their large and urgent needs for goods. In 1939, with a gross national product of $100 billion, our imports were $3 billion. After the war, with 55 million people employed and a gross national product of $155 billion, our imports would be about $7 billion or $8 billion.

Not only should the United States make itself prosperous, but it should *keep* itself prosperous. *So important is the United States in the world economy that a depression here is bound to produce a disastrous drop in the price of raw materials throughout the world and to throw most countries into an economic tailspin.*

The United States should support the principle of a large fund to protect the exchanges of the world from temporary pressure. We should not permit differences over the details to prevent its establishment in ample time to be available during the critical period when war-stricken countries will need goods far in excess of their immediate ability to pay for them. *Some* arrangement, even though imperfect in details, will be infinitely superior to no arrangement.

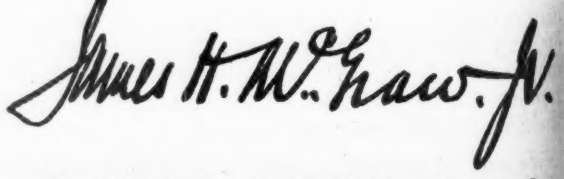
Finally, the United States should take the lead in breaking down barriers to trade. We are the logical country to do this, partly because of our immense domestic market, and partly because for most of the last twenty-five years this country has been able to sell other countries more goods than they have been able to sell to us. One of the greatest contributions which the United States could make to a sound and expanding world economy would be to bring our imports, as soon as practicable, up to our exports. *In other words, the United States, in the long run, should be hard to borrow from but easy to sell to.* The United States should implement this policy (1) by continuing the negotiation of reciprocal reductions in duty, and (2) by accepting exchange rates which make foreign currencies cheaper in dollars than they were in 1939. So great will be the world's need for goods that we can be sure that any dollar exchange earned by sales to us will be converted into American-made goods and will lead to larger exports.

Time was when the United States obtained about eight per cent of its standard of living by sending goods abroad and bringing back other goods. Before the war, however, we were getting less than five per cent of our living by international trade. If, after the war, we were gradually to raise the proportion of our standard of living obtained by trading with other countries to ten per cent of domestic production, our imports would be about $15 billion or $16 billion a year. Our people would be able to buy many things which they now cannot afford, and scores of countries which export raw materials and luxury products would feel the stimulus of rapidly expanding markets. Their expanded demand for road building machinery, mining machinery, machine tools, agricultural implements, locomotives, railroad cars, electrical equipment, trucks, automobiles, and a multitude of products of our factories would create a million or more additional jobs in our factories.

Although the United States would raise its standard of living by increasing its imports and its exports, it should honestly face the fact that the resulting shifts in production and employment would temporarily be painful for some people. The increase in imports would be in commodities which other countries can produce for less than the cost at which much of our output is produced—such as sugar, wool, copper, some fats and oils, wines, winter vegetables and fruits. The increase in our exports would come from those industries in which our superiority is greatest—particularly the manufacturing industries. Finally it would be advantageous, to the country as a whole, to shift a million or two workers from agriculture, where they earn about 60 cents an hour at best, to manufacturing, where they earn better than 80 cents an hour.

☆ ☆ ☆

The very fact that in economic matters the rest of the world is dependent upon the United States, exposes our country to great demands and to envy and misunderstanding. The United States must be willing to help the rest of the world, but its help should take the form of assisting other countries to help themselves. Never in all history has one country had such an opportunity to give the world a rising standard of living, to foster conditions under which peace flourishes. What greater tragedy could there be than to make the sacrifices which we are now making and fail to seize this chance to create a world of hope and opportunity in which the spirit of goodwill among nations is able to flourish.



President McGraw-Hill Publishing Company, Inc.

This *NEW* Sturdy, Smaller Transtat AC Voltage Regulator OFFERS INCREASED DESIGN POSSIBILITIES!



The new TH 2½A Transtat A. C. Voltage Regulator is half the size and less than half the weight of the smallest previous TH Transtat. When used as a dual unit, a further space saving is made possible by base-to-base mounting. In attaining this extreme compactness, AmerTran also introduced several mechanical innovations: the unique die cast brush arm with its generous heat dissipating surface; smooth commutator with solid insulation between segments; the operating shaft that can be quickly changed for table, panel or gang mounting; the Phenolic Thermosetting Plastic Base with its terminal barriers and other features.

Yet the TH-2½A Transtat's conservative rating is a working rating—output voltages are full load voltages. Exciting current is only 0.06 amperes. Control throughout working range never exceeds 0.4 volt increments. And like its larger brothers, it cannot disturb power factor, distort wave form or interfere with radio reception. Investigate its possibilities in your apparatus today.

Write for Bulletin 171-01

TYPE TH-2½A TRANSTAT FOR SINGLE PHASE OPERATION					
	VA	Frequency	Input Volts	Output Volts	Output Amperes
		50° Centigrade Rise			
Nominal	300	50/60	115	0-115	2.6
Maximum	340	50/60	115	0-130	2.6
TYPE TH-2X-2½A TRANSTAT DUAL UNIT. OPEN DELTA CONNECTED FOR THREE PHASE REGULATION					
		50° Centigrade Rise			
Nominal	520	50/60	115	0-115	2.6
Maximum	590	50/60	115	0-130	2.6

AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark 5, N. J.

AMER TRAN

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N.J.



★ Every installation made with Porcelain Protected Wiring Systems gives the user broad protection—in the matter of safety—in permanency—in adequacy—and in the assurance of low installation costs for most modern wiring results.

Because porcelain offers so much in protection its usage continues to increase for industrial, commercial, and residential wiring.

Let's look at some of the results of porcelain protection . . . rust and corrosion proof which is protection against maintenance and replacements . . . short proof and shock proof—both contributing to safety . . . complete insulation from the entrance switch to the very last outlet on the system.

The protective quality has excellent sales value. In making installations with Porcelain Protected Wiring Systems contractors gain prestige in their various communities.

Investigate the advantages of modern Porcelain Protected Wiring Systems which include the use of and have, as their components, Porcelain Knobs, Tubes, Cleats, and Porcelain Outlet Boxes, Switch Boxes and Covers.

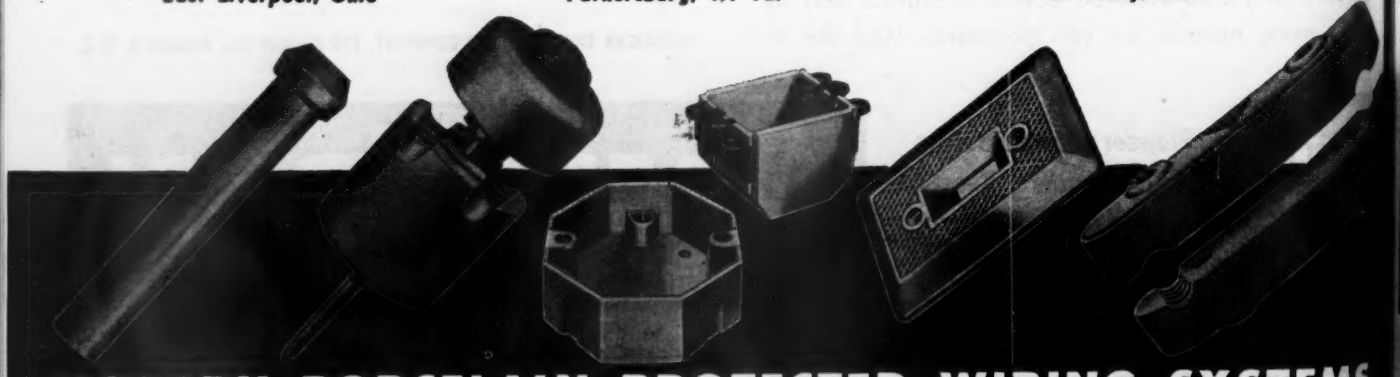
★ **ILLINOIS ELECTRIC PORCELAIN CO.**
Macomb, Ill.

★ **PORCELAIN PRODUCTS, INCORPORATED**
Findlay, Ohio

★ **SPECIALTY PORCELAIN WORKS**
East Liverpool, Ohio

★ **SUPERIOR PORCELAIN COMPANY**
Parkersburg, W. Va.

★ **UNIVERSAL CLAY PRODUCTS COMPANY**
Sandusky, Ohio



MODERN PORCELAIN PROTECTED WIRING SYSTEMS

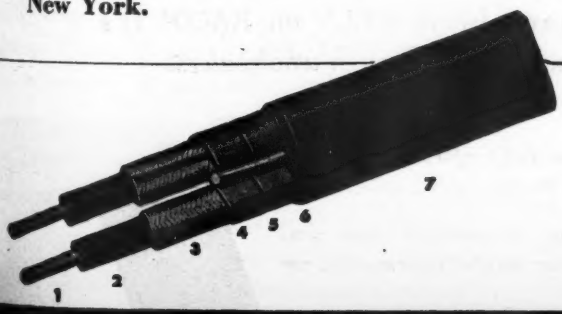


Though this is but one of many large war projects in which Walkerflex has been used, it is an outstanding job for several reasons other than size. The cable had to be so flexible that sharp bends could be made without cracking. Installation time had to be saved. The free stripping and easy handling qualities of this cable make this possible, for Walkerflex does not get sticky in hot weather, nor does the outer covering flake off. There were also other reasons for the selection of Walkerflex, some of which are named in the seven construction features listed below.

The engineers on this project were Tuttle, Seelye, Place & Raymond, New York; electrical contractors were Spitzer Electric Company, New York; and the material was distributed through Midway Electrical Supply Company, Inc., New York.

WIRE WITH WALKER

STUDY THESE 7 CONSTRUCTION FEATURES



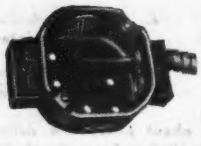
1. **Tinned copper conductors**
2. **Free-stripping insulation**
3. **Tough braid of cotton and paper fibres**
4. **Multi-fold kraft paper armor**
5. **Moisture-proofed jute cord**
6. **Paper sheath—keeps compounds from penetrating interior**
7. **Outer braid, treated to resist moisture, retard flame**

Ask your local wholesaler about prices and deliveries. For further information, write to Walker Bros., Conshohocken, Pa.



The Raco • All-Steel • Line rates No. 1 with electrical contractors throughout America because it's a "quality" line—it's clean, attractively packaged, and trade-marked—it identifies good workmanship, better materials! Accepted by architects and builders, it helps win approval for the contractor's work.

Raco rates No. 1 because it's a dependable line, a complete line. More than 31 years of engineering have kept Raco in step with the latest developments in the electrical field . . . have provided Raco • All-Steel • Products for every type of construction, for old and new building, for repair and maintenance jobs. Be sure—look for the Raco trade-mark. You can always RELY on RACO! It's the better line that is *sold nationally only through wholesalers.*



← DO-25 NJK—*Check this box carefully—for use with* either *BX or Non-metallic. More wiring room.*

CATALOG C-44—*New, up-to-date, see connector chart, comparative Box number chart and other helpful information.* →



Distributed by **ALL-STEEL-EQUIP COMPANY, INC.**
600 Kensington Avenue, Aurora, Illinois

RACO • ALL-STEEL • PRODUCTS
SWITCH BOXES • OUTLET BOXES • CONDUIT FITTINGS

NEED SAFETY SWITCHES P. D. Q.?

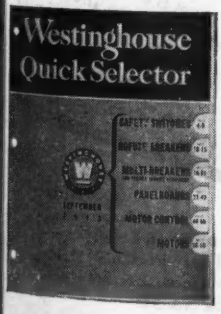


TAP THE "HOW-TO-DO-IT" ABILITY OF YOUR WESTINGHOUSE DISTRIBUTOR

USE THIS BOOK...

to simplify selection...
ordering... application

64 pages of highly useful ordering and application information are contained in this handy Westinghouse Quick Selector Catalog. Issued twice a year, it includes all frequently needed types and sizes of motors, controls, panel boards, gearmotors, circuit breakers and service equipment. Ask your Westinghouse distributor for your copy, or write Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., Dept. 7-N.



Your Westinghouse distributor offers two important sources of help on wiring problems.

First: A complete line of Westinghouse Safety Switches and fusible service equipment.

Second: Valuable "how-to-do-it" ability which combines knowledge drawn from Westinghouse headquarters, with the distributor's own wide, practical application experience.

Westinghouse Safety Switches provide the exclusive Westinghouse feature of the diamond-pointed break jaw which keeps arcing away from the contact area and prolongs switch life. For 575 or 600-volt circuits, the "De-ion" arc quencher provides added protection to switch parts and to personnel.

Whether your requirements call for Types A, C, D or special styles, your Westinghouse distributor can offer you prompt help . . . competent recommendations. Call on him. J-90515

SEE YOUR WESTINGHOUSE DISTRIBUTOR *FIRST!*

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

FASTER DRILLING and CHIPPING

WITH THE POWERFUL *Thor* ELECTRIC HAMMER

SAVES TIME AND COSTS ON ALL INSTALLATIONS!

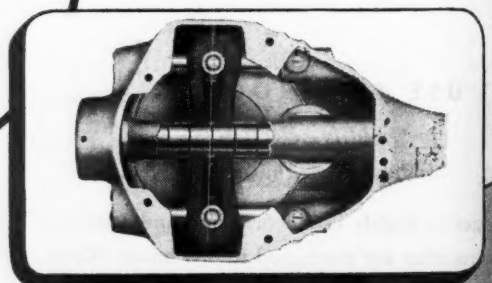
- POWER
- PORTABILITY
- BALANCED WEIGHT

COMBINED FOR FASTER WORK!



From light duty drilling of conduit holes in plaster to heavy duty drilling of anchor bolt holes in brick or concrete for sign hanging . . . for chipping ceiling grooves in stone or plaster . . . *for every electrical installation job,* the Thor Electric Hammer provides the power and handling ease that will save you time and operating costs!

The Thor Hammer combines the *power* of an exclusive "sling shot drive" with the *handling ease* features of balanced light weight and portability to make *quick work* of scores of different jobs in stone, wood or metal.



"SLING-SHOT DRIVE" PACKS MORE POWER INTO EVERY BLOW!

The Thor Hammer's radically different "Sling-Shot Drive" is a shock-proof rubber connection that drives the piston in powerful hammer action. It whips the piston back and forth 1,600 times per minute, acting as both power accumulator and shock absorber. The blow of the piston is not felt by the operator, nor is it transmitted to the gears or motor.

PLUS — ALL THESE ADVANTAGES!

HARDENED NOZZLE BUSHING—resists wear and is a separate replacement part.

FREE-RUNNING PISTON—rides in guide sleeve with no rigid connection to gear train . . . reduces vibration and wear.

TANGENTIAL TYPE VENTILATION—a patented Thor feature that insures maximum cooling efficiency.

UNIVERSAL MOTOR—special hammer design with patented Thor construction in hand made armature and commutator . . . and patented flexible lead connections which prevent crystallization and breaking off of lead wires.

LARGE BALL BEARINGS—on all rotating parts . . . sealed against dust and dirt.

ALUMINUM-ALLOY HOUSING—for maximum strength and durability combined with light weight.

For complete particulars, specifications and prices on Thor Hammers and other Thor Portable Electric Tools that will help speed your installation jobs, write for Catalog No. 38.

Thor Portable Electric Tools

INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. JACKSON BOULEVARD, CHICAGO 6, ILL.

Branches in Principal Cities

SOLD AND SERVICED BY LEADING DISTRIBUTORS EVERYWHERE



Inquisitive hands are SAFE FROM SHOCK

FA Load Center, with 10 S. P. FA Type AC Thermag Circuit Breakers, for light and appliance branch circuits. Cat. No. LC-100-3L7F. List Price $19.55.



This is the FA Type AC Thermag Circuit Breaker Unit. Capacities 15 to 50 Amp., 120 Volt AC. It combines the time-delay action of the proven THERmal trip with the fast MAGnetic trip. The circuit breakers are made in individual pole units, but can be furnished with a cross bar to operate as a double pole main breaker or branch circuit breaker with one operation, with individual trip per pole on overload or short circuit. (Circuit Breakers are NOT sold separately.)

Safety is a prime factor in the construction of

FA TRADE MARK

TYPE AC THERMAG CIRCUIT BREAKER

LOAD CENTERS and SERVICE EQUIPMENT

All current-carrying parts are covered — prying hands can't touch them . . . Needless circuit interruptions are prevented when momentary, harmless overloads occur — but the circuit breakers "trip" on short circuit or harmful overload. Requiring no fuses, the circuit breakers are operated like an ordinary tumbler switch. Simply return the handle to the *ON* position when the cause of the short circuit has been removed.

The home owner likes these FA Products because of their attractive pearl-gray finish, natural brown Bakelite base units and ivory toned operating handles — because they afford modern protection with ease of operation — and because of their long life. (The Circuit Breakers are Underwriters' Laboratories-tested for *ten thousand* complete operations.)

Wide gutters and ample knockouts make them popular with contractors and builders. They are quickly and easily installed, and afford real economy in labor costs . . . Many architects and contractors recommend or specify FA Equipment, which not only meets Underwriters' Laboratories requirements, but *exceeds* them.

Use the Coupon — Get This Bulletin

It contains complete descriptions, dimensions, capacities, prices, wiring diagrams and suggested specifications. You'll find it helpful . . . Frank Adam Electric Company, Box 357, St. Louis (3), Mo.

FRANK ADAM ELECTRIC COMPANY
Box 357, St. Louis (3), Mo.

Please send me Bulletin 63.

Name.....

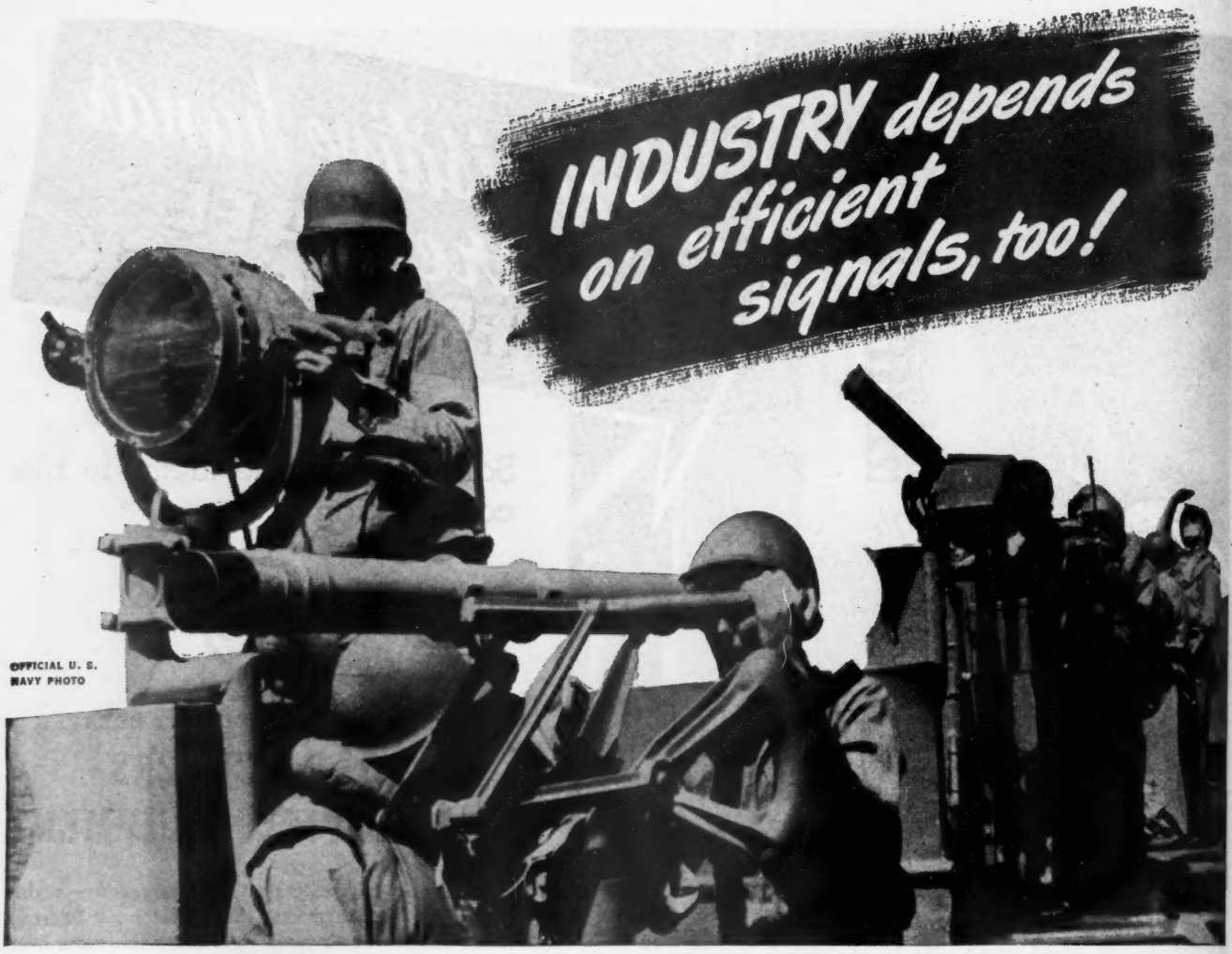
Title.....

Company.....

Street and Number.....

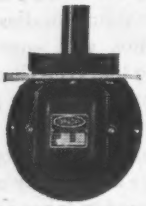
City.....Zone.....State.....

Frank Adam
ELECTRIC COMPANY
ST. LOUIS



FARADAY

AUDIBLE ELECTRIC SIGNALS



CHIMES. Easily installed heavy duty type with xylophone bar and resonator. UNI-PACT feature if desired. Clear, pleasant tone, advanced design, dependable under all conditions.

SIRENS. Motor-driven industrial type with penetrating shrillness; sturdy, dependable, weatherproof.





AIR TRUMPETS. The most powerful horn of its size on the market. Furnished in complete operating units ready for connecting to power circuits.

Our complete line includes
SIGNAL EQUIPMENT
to meet your customers' needs exactly

Yesterday's signal equipment seldom meets today's needs. Tomorrow the picture may change again. Faraday industrial signals are abreast of the times. Their advanced design and the flexibility of the UNI-PACT feature mean added efficiency and economy for your customers. Signals can be changed in any part of any plant, easily, quickly, without changing electrical connections—whenever conditions require it.

Special Service for Special Needs

You can increase your signal business by selling Faraday special service, where a customer's manufacturing problems call for specially designed signal equipment. The Faraday factory engineering staff is experienced in planning such devices. Simply send specifications, and quantity required, to our factory at Adrian, Michigan.

Send for FREE Catalog! The new complete catalog of Faraday Signal Equipment is an invaluable reference manual. Write today on your letterhead for your FREE copy.

FARADAY ELECTRIC CORPORATION
A consolidation of Schwarze Electric Co. and Stanley & Patterson
ADRIAN, MICHIGAN



RUBBER TAPE

1. Guaranteed Footage
2. High Grade Compound
3. High Tensile Strength
4. High Elongation
5. High Dielectric Strength
6. Uniformity of Thickness
7. Excellent Fusion
8. High Insulation Resistance
9. Excellent Tackiness
10. Colorful, Attractive Boxes

FRICTION TAPE

1. Guaranteed Footage
2. Substantial Fabric
3. High Tensile Strength
4. High Adhesive Strength
5. High Dielectric Strength
6. Uniform Thickness
7. Uniform Width
8. Excellent Tackiness
9. Strong, Durable Core
10. Colorful, Attractive Boxes



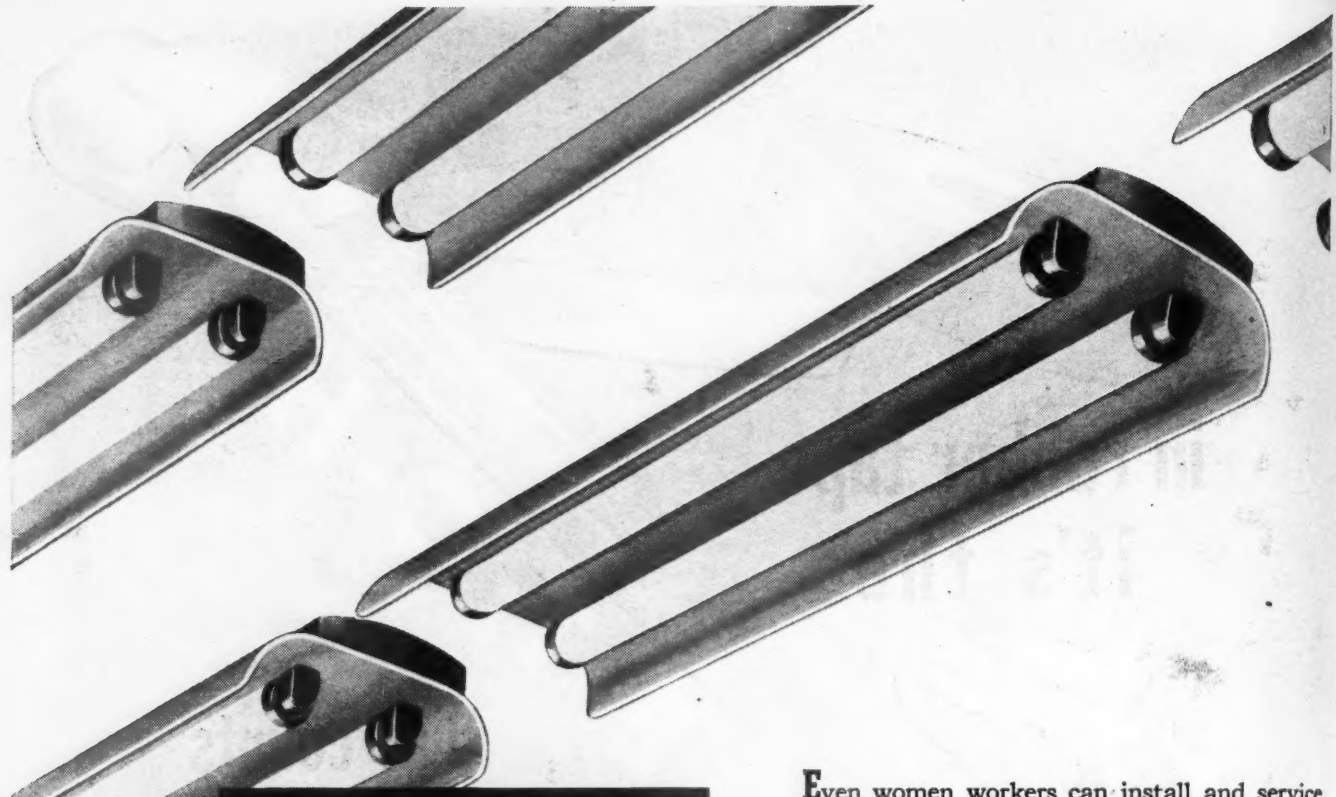
SOLD THROUGH RECOGNIZED INDEPENDENT WHOLESALERS

HAZARD INSULATED WIRE WORKS

Division of The Okonite Company

Wilkes-Barre, Pennsylvania

3776



HIGH-LIGHTS

THE LIGHT-WEIGHT FIXTURE FIELD



Even women workers can install and service Masonite* Reflector Shapes . . . for these simply designed, semi-plastic fixtures are remarkably light and easy to handle.

There's a big saving in shipping costs, a continuous saving in maintenance expense. And more and more manufacturers are discovering that these modern, streamlined reflectors help get the maximum efficiency out of fluorescent lighting units.

Dense and durable despite their amazingly light weight, Masonite Reflector Shapes resist moisture . . . have low electrical conductivity . . . are non-scaling . . . will not rust . . . take fine reflecting finishes perfectly.

Here's a new leader of the "Light Brigade"—a money-saving, hardboard reflector that's fast winning acceptance throughout industry. For complete details, please write Masonite Corporation, 111 West Washington Street, Chicago, Illinois.

MASONITE CORPORATION

*TRADE-MARK REG. U. S. PAT. OFF.
COPYRIGHT 1944, MASONITE CORP.



WORLD-GIRDLING PROVING GROUND

The production here — and the maintenance there of ships, planes, tanks, guns, ammunition for service at the four corners of the globe, has proved a proving ground for welding cable.

From it comes super-flexible cables to withstand repeated flexing.



—tough jackets to resist mechanical abrasion

—slick surface to shed dirt and grease

—non-kinking for ease of handling and for safety.

—Collyer Welding Cables.

COLLYER WELDING CABLE

Near you is a Collyer representative ready to cooperate with you on welding wire.

COLLYER INSULATED WIRE CO.

PAWTUCKET, RHODE ISLAND

Enjoy using this threader with *fast mistake-proof* workholder



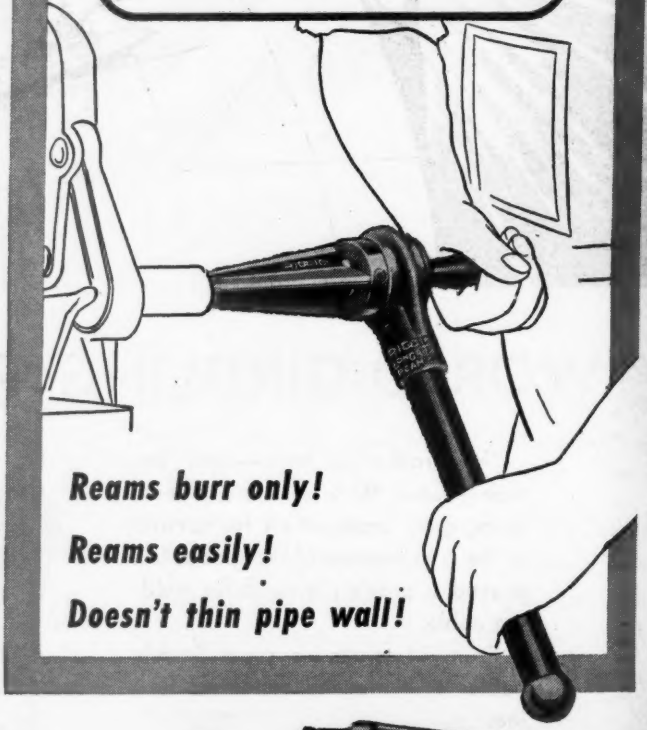
RIDGID No. 1R Poster, 1" to 2" pipe



Face View of No. 1R Die Stock.

● A popular-priced die stock with a popular workholder — it sets to pipe size quickly, correctly — no bushings! Threads smoothly — action is direct, handle to head to chasers; no cock-wobbling. Posts carry no load, only taper the threads, are separately replaceable. Rugged steel-and-malleable construction. Perfect threads on 1" to 2" pipe, alloy or high-speed steel dies. Ask your Supply House.

New RIDGID Pipe Reamer with Extra Long Taper







● No more reaming thin of threaded ends or splitting walls of pipe or conduit! Extra long-taper of this new RIDGID Reamer trims the burr out neatly and safely with easy feather-light ratcheted strokes — saves you time, effort *and pipe.* It's made complete with ratchet handle, or you may buy reamer alone for use in your RIDGID No. 00R threader handle. Capacity ⅛" to 2". You'll like this smart new work-saver tool — ask your Supply House. Immediate delivery!

Sold by Supply Houses Everywhere

RIDGID ★ PIPE TOOLS ★

Millions of RIDGID Tools in use





THE RIDGE TOOL COMPANY
Elyria, Ohio, U. S. A.



All Featured ALL METAL • FLUORESCENT INDUSTRIALS •

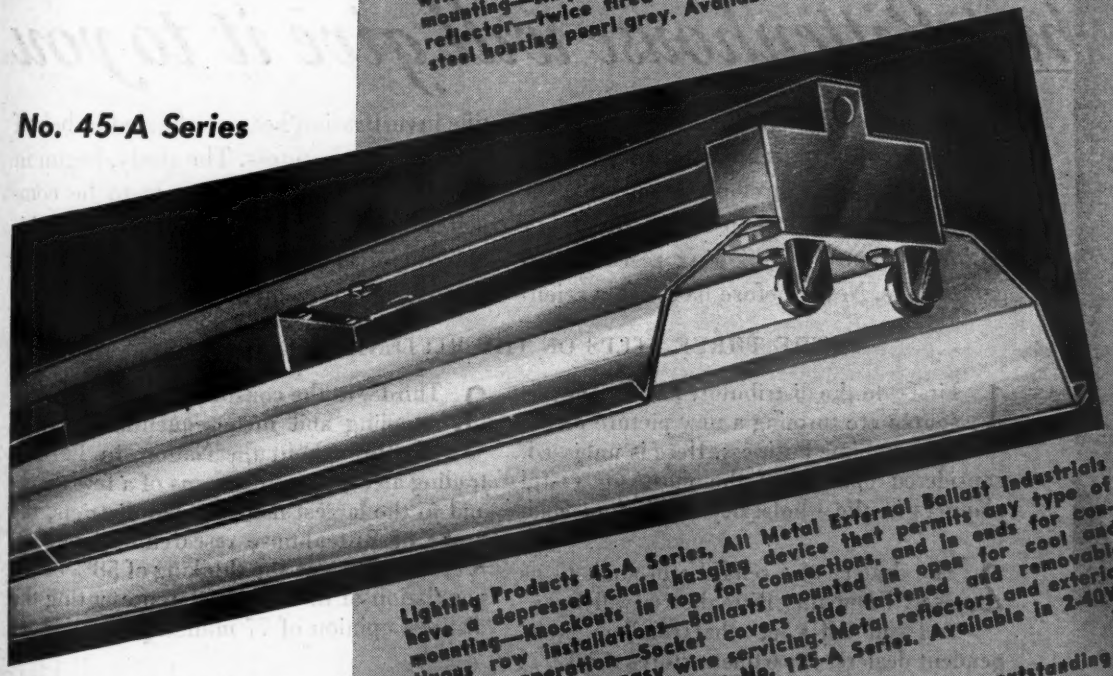
for either conventional or instant start lighting . . . . .

No. 125-A Series



Lighting Products 125-A Series, All Metal Enclosed Ballast Industrials incorporate all labor saving installation and maintenance features. Other features are drop ends for socket protection—starter changing without lamp removal—K.O.'s in ends for pull switches and continuous mounting—simple to install for any type of hanging. Finish inside of reflector—twice fired white enamel; exterior of reflector and all steel housing pearl grey. Available in 2-40W, 3-40W, and 2-100W units.

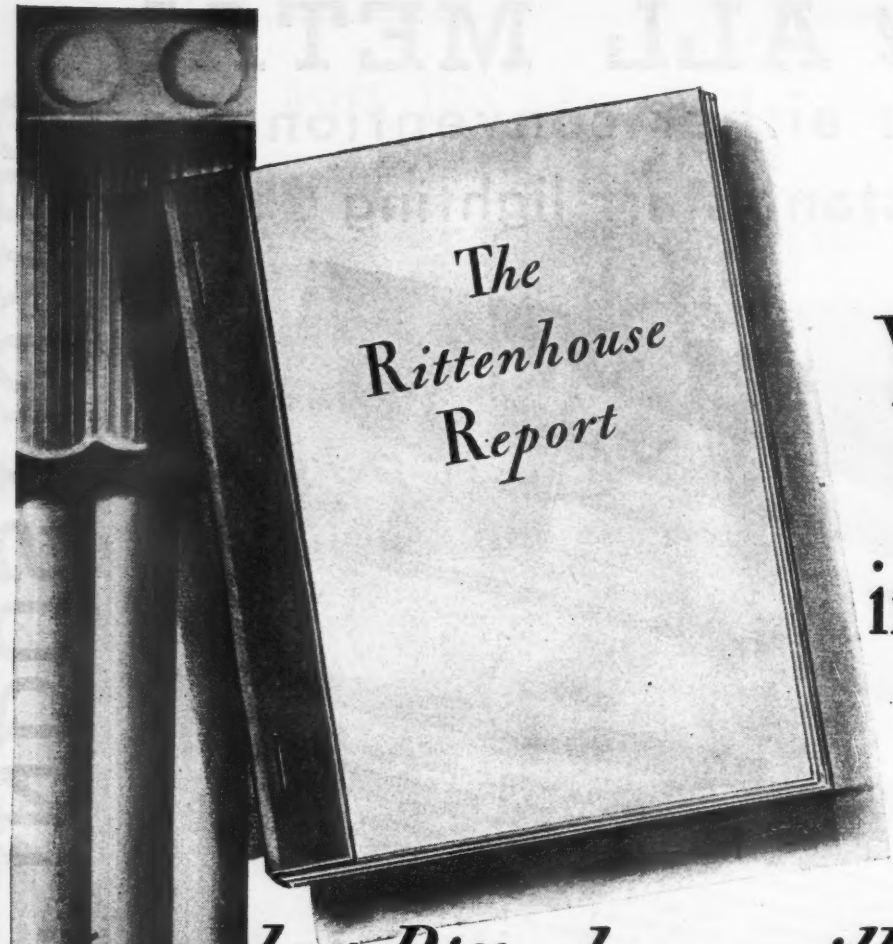
No. 45-A Series



Lighting Products 45-A Series, All Metal External Ballast Industrials have a depressed chain hanging device that permits any type of mounting—Knockouts in top for connections, and in ends for continuous row installations—Ballasts mounted in open for cool and efficient operation—Socket covers side fastened and removable channel covers for easy wire servicing. Metal reflectors and exterior of units finished the same as No. 125-A Series. Available in 2-40W, 3-40W, 4-40W and 2-100W units.

Send today for complete information on this new outstanding Metal Line.

LIGHTING PRODUCTS INCORPORATED
HIGHLAND PARK, ILLINOIS . . . . . U. S. A.



You can't *buy* this information...

but Rittenhouse will give it to you

. . . full and complete, the first comprehensive picture of the chime business based on an exhaustive three-phase survey conducted by Rittenhouse in conjunction with nationally known marketing research organizations. Never before has such a scientific investigation been conducted in behalf of the chime business. The study, begun in May, is a continuing one not to be completed until Fall. Carefully planned, it involves considerable cost. This survey gives definite facts on which to base conclusions.

THE THREE STEPS OF THE RITTENHOUSE STUDY

1. First—to the distributor. Facts from this source are forming a new picture of the future chime business. Here is unbiased, considered opinion of the most successful planners in the wholesale distribution field.

2. The dealer, who sells the product to its user. From this Rittenhouse will know, and can tell you, what retailers, independent dealers, department stores think . . . how to make chime sales easier—more profitable—how to increase the volume sold.

3. Third—to the consumer. Not in a spotty sampling and inconsequential manner, but throughout the Nation, in 129 key trading areas, covering towns of a few thousand to the largest metropolitan districts, the probe of Rittenhouse research will be felt. A cross-section of the thinking of 58% of the population of the country—representing the distilled opinion of 77 million people.

Next month Part Two of Rittenhouse's Report To Its Trade, giving actual facts developed through the studies, will be carried in several leading electrical appliance trade magazines. Be sure to watch for it.

Rittenhouse

The A. E. Rittenhouse Company, Inc.
Honeoye Falls, New York

TOMORROW'S BETTER DOOR CHIMES

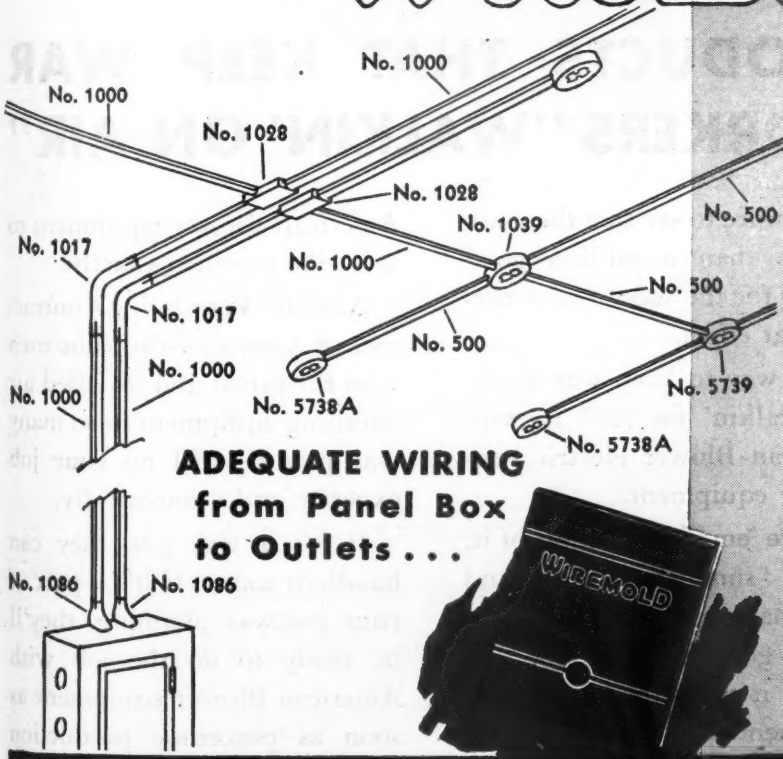
the problem

Practical Wiring Methods adaptable to the requirements of all the new lighting developments

FLUORESCENT
INCANDESCENT
COLD CATHODE
AREA LIGHTING
WORK LIGHTING
BUILT-IN LIGHTING
DECORATIVE LIGHTING
INFRA-RED

the answer

WIREMOLD



ADEQUATE WIRING from Panel Box to Outlets . . .

With Wiremold Wiring Systems and methods of installation, basic wiring or rewiring needs can be met for any type of lighting installation . . . in any type of building . . . from panel box to outlet. Wiremold Raceways are available in sizes, types and capacities comprising 10 complete wiring systems with installation fittings, and interconnecting with each other or with already installed wiring. Wiremold has kept pace with advances in the lighting field . . . today offers you the specialized installation methods required for lighting installations now being planned. Wiremold availability and simplified installations stand ready to meet the first demands of reconversion as they have met the urgent demands of war production.

Know your Wiremold . . . write at once for the Wiremold Catalog and Wiring Guide No. 16; also for other Wiremold literature. The Wiremold Company, Hartford 10, Conn.

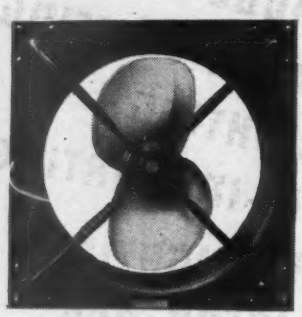
WIREMOLD CAN HELP YOU PRODUCE FOR WAR . . . WHILE YOU PLAN FOR PEACE!

KNOW YOUR
WIREMOLD
AND YOU KNOW THE ANSWERS

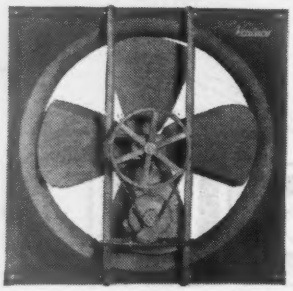
THE WIREMOLD COMPANY HARTFORD 10, CONN.

AMERICAN BLOWER

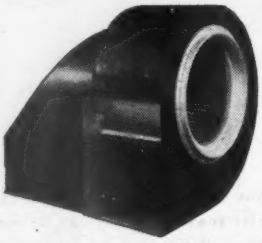
MECH. DRAFT · AIR-CONDITIONING · FLUID DRIVES · DUST COLLECTORS



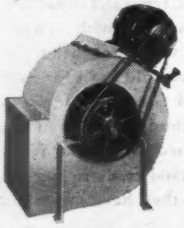
Ventura Fan with direct connected 2-speed fully enclosed motor.



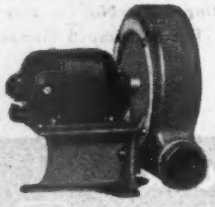
Ventura Fan with V-Belt Drive.



ABC Utility Set for use with duct system.



ACF Fan with V-Belt Drive.



Type P Pressure Blower.

ARMY (E) NAVY

For Excellence in Production



PRODUCTS THAT KEEP WAR WORKERS "WALKIN' ON AIR"

We venture to say that there are no less than a million good reasons for the success of America's war effort.

One way to keep war workers "walkin' on air" is with American Blower electric ventilating equipment.

"Give 'em air," and lots of it, winter, summer, spring and fall—that's good ventilation, and it's good business, too. You can do it with the ventilating equipment shown on left. Regardless of the process or purpose, there's a type and size of American Blower equipment to meet the problem exactly.

And the Ventilating Contractors of America—the same men who furnished and installed air handling equipment in so many war plants—will do your job expertly and economically.

If it's a war job, they can handle it today. If it's a part of your postwar planning, they'll be ready to do the job with American Blower equipment as soon as peacetime production is resumed. Remember, "good ventilation is good business."

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION



famed for Beauty and Efficiency

Where customers demand quality in a four-lamp pendant fluorescent luminaire, Curtis StarLux is a natural choice.

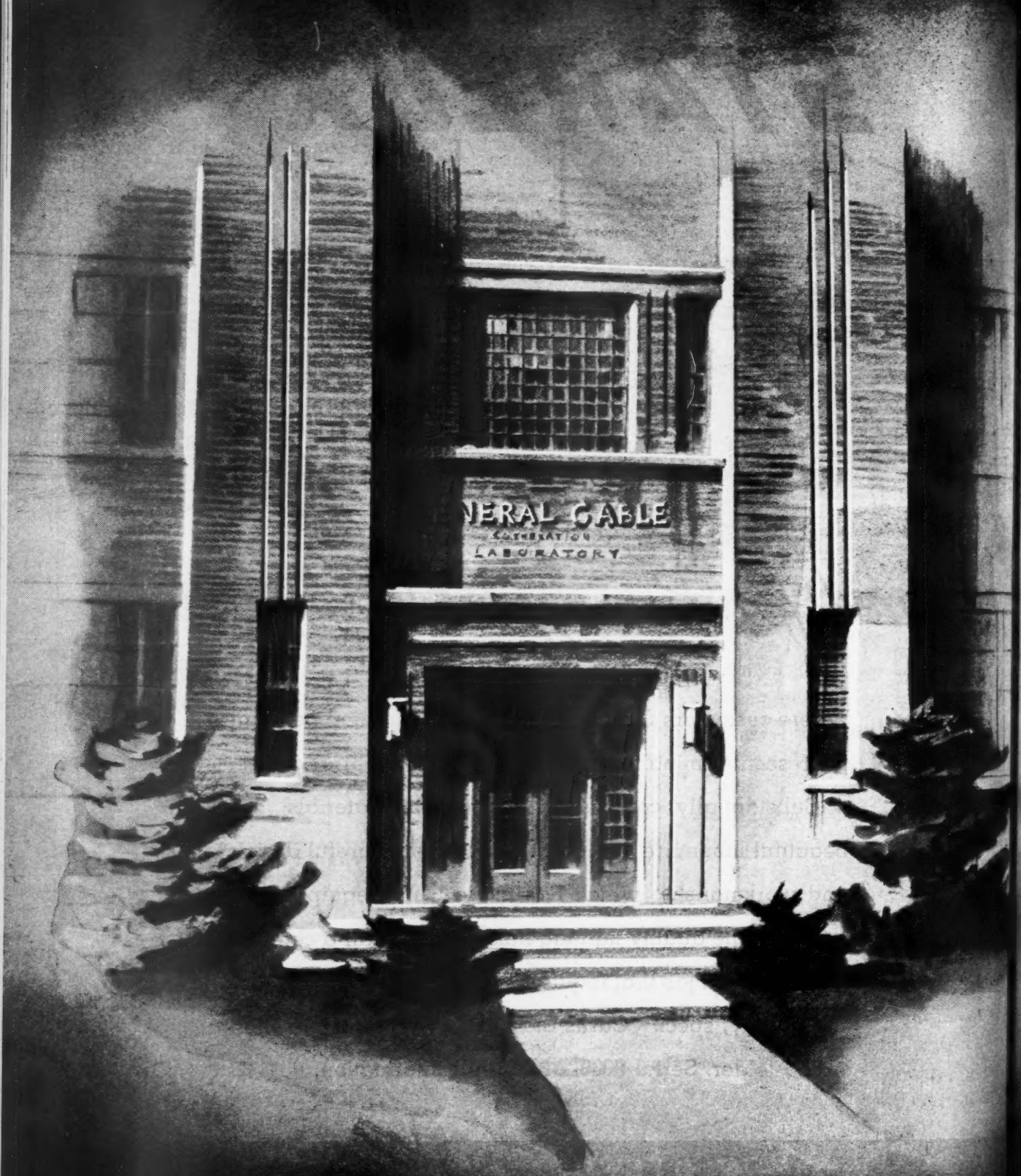
● Substantially constructed of durable materials, this beautiful luminaire is characterized by the careful design and workmanship which has made Curtis equipment a leader in the quality lighting field for over half a century.

● On the next job that requires beauty, efficiency and lasting quality, specify Curtis StarLux. ● Write for our illustrated folder, Serial 2039, giving full information.

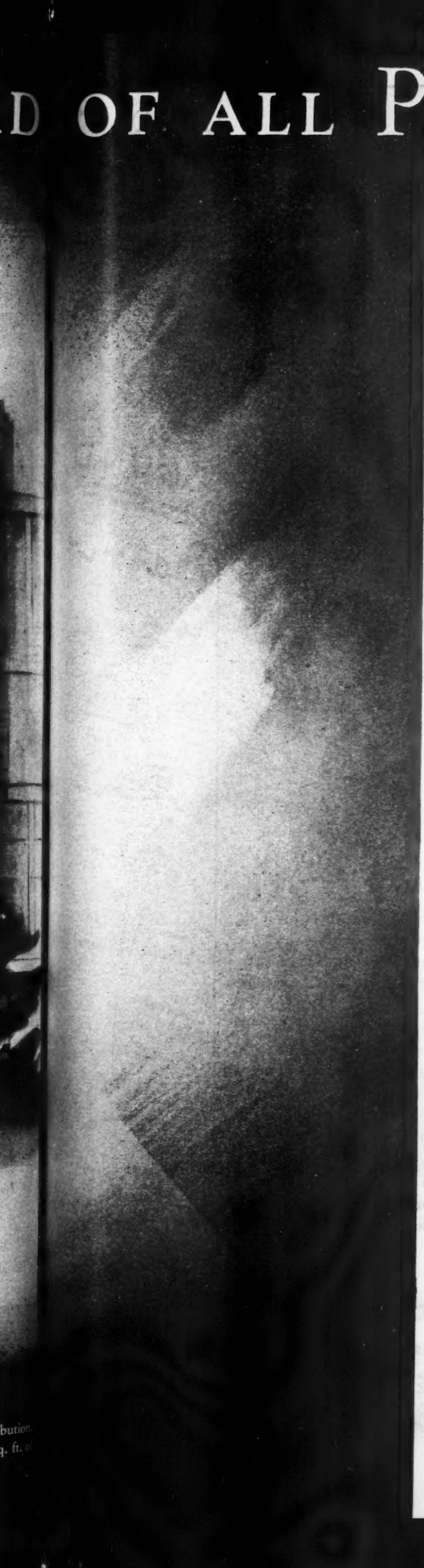
CURTIS *Lighting*, INC.

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

RESEARCH...SPEARHEAD



The 80 practical specialists who work in this magnificent building at Bayonne, N. J., have every facility—chemical, physical, metallurgical—to aid them in bringing nearer their goal—extending to the utmost the effective means of electrical transmission and distribution. Built in 1941, the structure has already grown to 60,000 sq. ft. of floor space—is planned for further expansion as needed.



D OF ALL PROGRESS...

THE FIRST GREAT LABORATORY DEVOTED EXCLUSIVELY TO RESEARCH ON ELECTRICAL WIRES AND CABLES

. . . thus "basic research in a particular industry devolves naturally upon the leading manufacturer." General Cable has been alert to its responsibility. In this great Laboratory are maturing the insulation discoveries and product developments which will loom large in days ahead.

GENERAL CABLE CORPORATION



Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

don't straitjacket a Good Genie



Don't straitjacket the genie of Electricity by poor planning of the electrical wiring in your post-war buildings. Anemic circuits, wiring that is insufficient and too small in capacity, lose wattage that is paid for but never gets to the machine or appliance.

Not only must yesterday's wiring requirements be discarded as the criterion, but proper note must be taken of wiring needs far into the future. To do any less is to condemn a building to early electrical obsolescence, for the greater use of electrical equipment that is promised us will be seriously hampered in buildings that are inadequately wired.

Adequate, proper wiring is a *must,* if tomorrow's buildings are to make full use of cheap, plentiful, labor saving electricity. The Okonite Company, Passaic, New Jersey.

SAME SIZE CONDUIT



#14 #12

Wire *size* is as important as having sufficient wiring. For instance, No. 14 wire has been a standard in building for generations yet No. 12 wire will carry one-third more current, reduce voltage drop by more than a third, deliver more power for your money and yet requires no larger conduit or fittings.

ADEQUATE WIRING SAVES — THE KEY TO INCREASED PRODUCTION

3608

OKONITE and HAZARD

OKONITE SINCE 1878 **INSULATED WIRES AND CABLES**

Follow THIS line of SOUND reasoning

2
+2
4

when you talk to ARCHITECTS or OWNERS

Stars of Leadership

ARE HARD TO WIN...HARDER STILL TO KEEP!

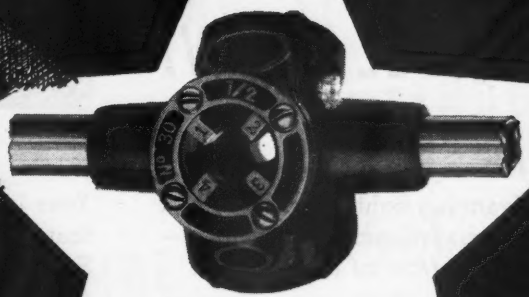
● Top-ranking leaders know there's more to leadership than glory—there's big responsibility, too!

In Pipe Tools—for nearly half a century TOLEDO has maintained unbeatable quality and performance in their complete line . . . with unceasing Research.

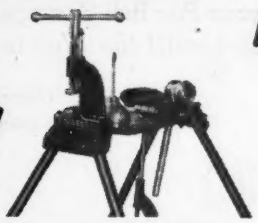
These *better* Toledo products are backed by progressive-minded engineering, manufacturing and sales policies. Whatever your needs in Pipe Tools today...and tomorrow...specify TOLEDO! The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.

TOLEDO

PRECISION PIPE TOOLS



3-WAY THREADER — lightest, smallest and easiest to operate of all 3-way tools! No. 30 threads ⅜" to ¾" pipe, weighs 43¼ lb. No. 31 threads ½" to 1" pipe, wt. 7 lb.



Open-Side PIPE VISE — practical, convenient, quality-built. Capacities for ⅛" to 4½" Pipe.



Black Sulphur Base THREAD CUTTING OIL —for smooth, sharp, accurate threads. Specify TOLEDO Cutting Oil in one-gallon sealed cans or 5-gallon sealed pails.

Continuous Supplies...

CALL FOR MOUNTING DOLLARS



Official U. S. Coast Guard photo



Official U. S. Marine Corps photo

....STEP UP YOUR PAY ROLL PLAN!

War is a continuous job.

Ever-widening, ever-advancing fighting fronts call for a never-ending flow of manpower and materiel—*financed by a continuous flow of money.*

Your responsibility as top management increases with the mounting tide of battle. You've been entrusted with two major responsibilities—steadily maintained production, and steadily maintained War Bond Sales through your Pay Roll Savings Plan.

So keep this one salient fact before you at all times: *The backbone of our vital war financing operation is your Pay Roll Savings Plan.*

Your job is to keep it constantly revitalized. See to it that not a single new or old employee is left unchecked. See to it that your Team Captains solicit everyone for regular week-in and week-out subscriptions. And raise all percentage figures wherever possible.

Don't underestimate the importance of this task. This marginal group represents a potential total sales increase of 25% to 30% on all Pay Roll Plans.

Constant vigilance, in a quiet way, is necessary to keep your Pay Roll Savings at an all-time high. Don't ease up—*until the War is won!*



Back the Attack!

SELL MORE THAN BEFORE!

The Treasury Department acknowledges with appreciation the publication of this message by:

ELECTRICAL CONTRACTING

This is an official U. S. Treasury advertisement prepared under the auspices of Treasury Department and War Advertising Council

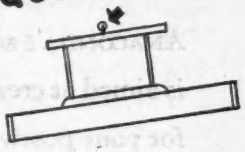
WESTINGHOUSE
COMMERCIAL
FLUORESCENT
LUMINAIRES

ARE EASY TO INSTALL

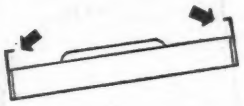


LW-160 UNIT

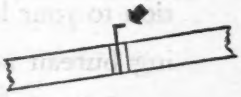
TWIN STEM HANGERS REQUIRE ONLY ONE POINT OF SUPPORT



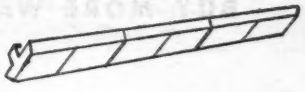
SINGLE UNITS ARE CEILING MOUNTED WITH TWO SIMPLE BRACKETS



CONTINUOUS ROWS REQUIRE ONLY ONE HANGER OR BRACKET PER FIXTURE



UNITS CAN BE JOINED FOR CONTINUOUS ROWS



You'll never find more versatile lighting units than the new Westinghouse Fluorescent Commercial Luminaires. Each model in the entire, complete line can be stem or ceiling mounted — hung singly or continuously. What's more, each unit requires a minimum of time for mounting — with fewer holes to drill, less hangers or fixtures to install, and line leads made accessible by loosening one screw.

Easy and flexible mounting of Westinghouse Fluorescent Commercial Luminaires means a savings in installation cost — less disturbance or time-out for personnel in relighting your office or drafting room. Full details are available from your nearest Westinghouse Lighting Distributor. J04010

Westinghouse *Lighting Equipment*

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electrical Wiring is Basic!

That's why Anaconda's national advertising drive is important to every electrical contractor

ANACONDA's advertising campaign is aimed at creating a sounder basis for your postwar business. It urges postwar planners to allow extra capacity in wiring plans. Naturally, this will increase the demand for *your* services—and service equipment.

Don't overlook the opportunity to tie in with this important campaign. Plan now to get a maximum share of postwar electrical business. Link your own promotion to your local adequate wiring bureau activities and Anaconda's basic advertising theme: It's always wiser to Wire Ahead! 44282A

BUY MORE WAR BONDS



Full-page Anaconda advertisements running regularly, in color, in Time, Newsweek, Business Week, and a list of industrial publications reaching America's leading postwar planners.

ANACONDA

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation

FOR BETTER WIRING

Wiring is the business of the electrical contractor. His responsibility for upholding good engineering adequacy and safety standards is clear. It is good business. It fosters a sound market for his goods and services. It helps him to serve his customers at a high level of technical competence with confidence and pride in able craftsmanship. And besides that, contractors, as experts in a highly technical field, have a genuine sense of moral obligation to the community, a natural desire to do exemplary work and to give the customer a full measure of their experience and know-how.

Better wiring is a vital concern of labor, too. It means more work and bigger payrolls. Good workmanship standards enhance the stature of the craft. And as good wiring is an essential ingredient of electrical progress, the interests of labor today and in the long run are inevitably aligned with better standards and more adequate wiring design.

Among electrical manufacturers, the breadth of activity enforced by war needs has brought more and more attention to adequate wiring. Men who once were content to stick closely to problems of product perfection and manufacturing techniques are actively promoting the cause of better wiring. They have become acutely conscious of the vital role that wiring plays in the application and use of the products and appliances to which they have devoted their time and genius. And utility men, seeking new markets for kilowatt hours, know from hard experience what tight wires can do to the best of load building plans.

There have always been conflicts of policy and practice between these major industry groups. Today, however, these are unimportant compared with the common cause of better wiring postwar.

The tremendous potential of the days ahead for all of the electrical industry is clearly apparent. It can be developed fully only if we are willing to take an industry-wide view, not only to accept but to actively seek out areas of joint interest, to bring many forces to bear on common market opportunities.

Wiring is the connecting element. It is the pathway for more kilowatt hours. It provides the power and convenience for tomorrow's appliances. It contributes to the design and operation of new lighting systems. It links control with the point of utilization.

In the days ahead there are going to be many conferences and meetings bearing on postwar projects in every branch of the industry. Better wiring installed according to sound standards ought to be a part of every plan. It all boils down to this. The manufacturer who wants to market a new washing machine or an electronic heater; the power company that wants to build new load on Main Street or rural lines; the business agent who wants to see his men on full time; all have a common stake with the contractor. Better wiring opens the way to their individual objectives. It also clears the way to new industry goals.

Wm. T. Stuart

Post-war pipe dreams your customers can't count on



LIGHTING THEIR PLANTS WITH LUMINOUS PAINT — Someday, maybe, a paint that's charged with atomic energy will flood the nation's plants with light—fixtures won't be necessary. But today it's just another pipe-dream.

BUT THEY CAN PLAN RIGHT NOW

LIGHTING THAT'S RIGHT FOR EVERY SEEING TASK



You will be able to sell your prospects new industrial lighting units both incandescent and fluorescent, which will furnish an adequate level of glareless illumination for jobs that it once seemed impossible to light well. In areas where combustible dusts are present, for example, sealed illumination will eliminate the fire hazard, and simplify maintenance. For planning, selection and installation aid, Graybar Lighting Specialists are at your disposal.

GRAYBAR'S NATIONWIDE NETWORK

of more than 80 warehouses assures you a convenient local source of supply for more than 60,000 electrical items — backed by experienced application aid on problems of wiring, lighting, intercommunication, and power apparatus. A Graybar Man near you is ready to make the electrical supplies that your contracts may call for his personal responsibility. Why not take advantage of his time-saving assistance? 5517

via GraybaR

ADEQUATE WIRING SERVES AND SAVES — THE KEY TO THE HOME OF TOMORROW

GRAYBAR ELECTRIC COMPANY
IN OVER 80 PRINCIPAL CITIES
Executive Offices: 420 Lexington Ave., N. Y. 17, N. Y.

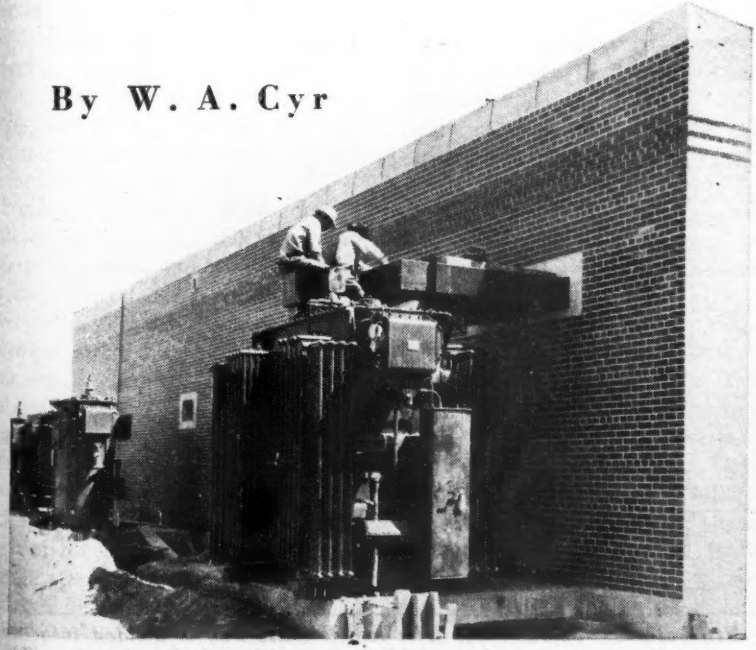


WINDOWLESS, air conditioned, the central maintenance shop is lighted by combination mercury vapor and incandescent units, to produce about 27 foot-candles at floor level.

Wiring for Steel

Our newest steel plant at Geneva, Utah, was designed from the ground up for efficient electrical operation. High voltage loop distribution, intricate cable and bus installation and extensive floodlighting are some of the features.

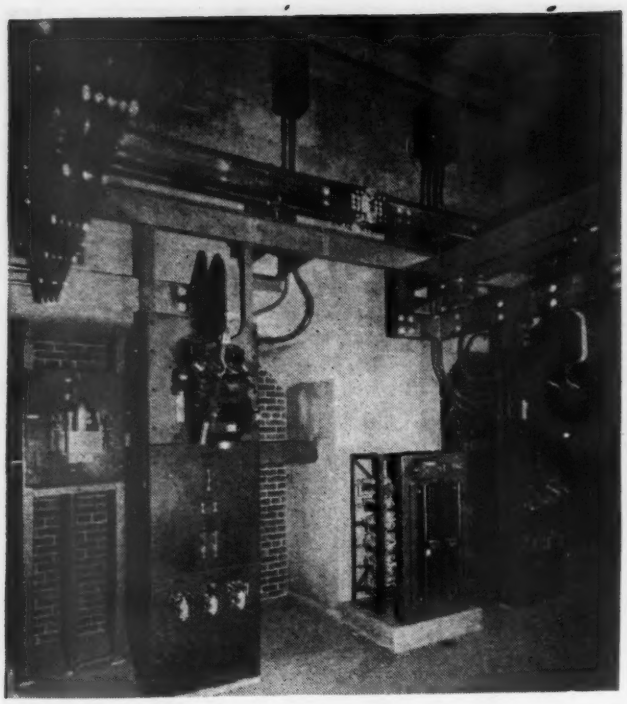
By W. A. Cyr



PREPARING BUS AND CABLE connections for transformers on the outside of one of the substations.

OUR newest fully integrated steel plant at Geneva, Utah, incorporates the most modern electrical methods with ideal operating conditions. It was financed by the United States Government through the Defense Plant Corp., but built with all the skill and experience of the U. S. Steel Corp. Located almost equidistant and within relatively short haul from the West Coast's four shipbuilding and manufacturing areas, Seattle, Portland, San Francisco and Los Angeles, it also enjoys a distinctly favorable relation geographically to the sources of raw materials—iron ore, coal, limestone and dolomite.

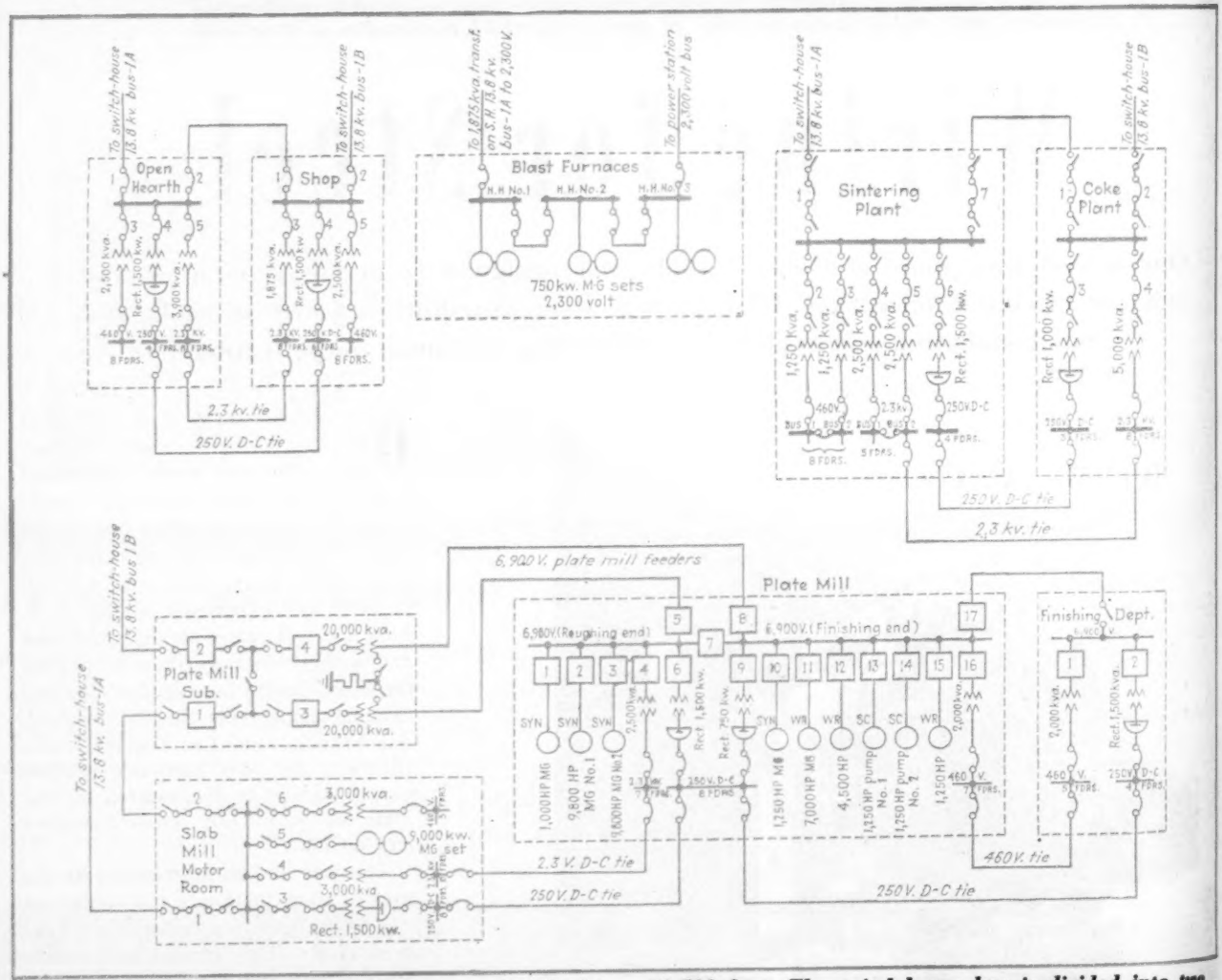
The war and its restrictions on the uses of some materials and equipment caused changes from what might have been ideal. This applied to the electrical design and installation as it necessarily did to the other construction details. The plant started on paper as an idea prospect in May 1941, became



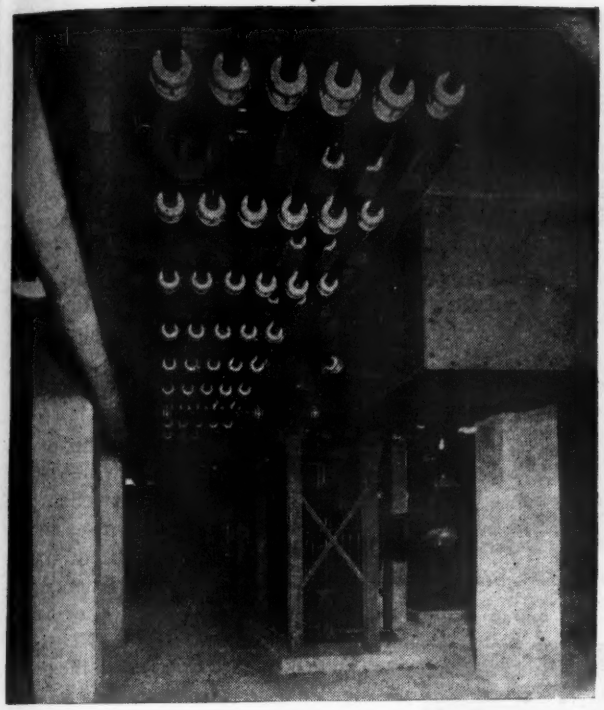
***COPPER BUS** structure for carrying direct current to the finishing stand motors.*



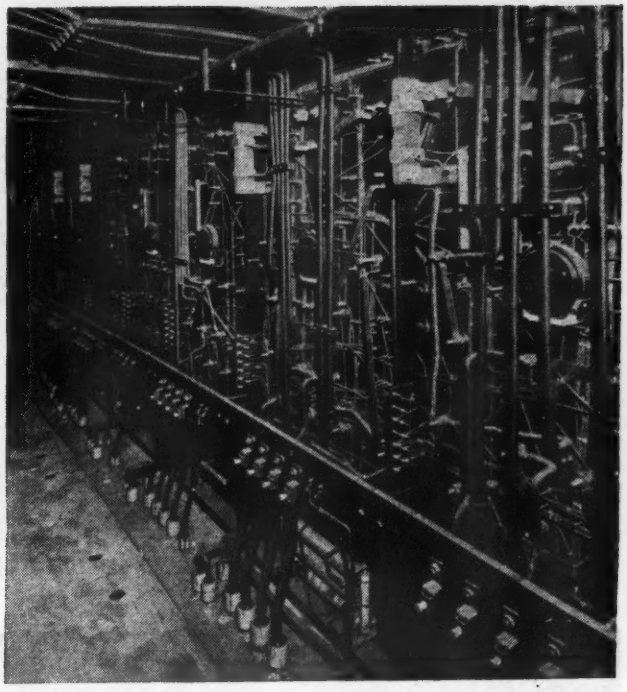
***FEEDERS** from 9,800 hp. motor-generator sets to the finishing stand drive motors.*



***SINGLE LINE DIAGRAM** of the 13.8 kv. distribution. Plant capacity is supplied from 138 kv. power lines with a 40,000 kva. transformer bank to get the 13.8 kv. distribution voltage, plus a 13,800 volt generator rated 62,500 kva. The switch-house bus is divided into two sections 1A and 1B connected by a bus-tie breaker. The various loop feeders feed from both sides of the sectionalized bus.*



OVERHEAD RACKING of cables. Bus insulators are mounted on supports above the cable racks.



CONTROL PANELS for auxiliary motors were set up on precast concrete pull boxes.

a project officially in November that year, broke ground in April 1942, made coke in December 1943, cast pigiron ingots in January 1944 and started rolling ship plate for West Coast shipyards in March 1944.

No need here to go into the streamlining of the plant to flow the materials in at one end of a two and a half mile long, 1600 acre, plant site at the edge of Lake Utah, near Provo, some 35 miles south of Salt Lake City. Nor into its coke making, blast furnace, open hearth and rolling and structural mill equipment or its general modernity except as electricity plays a part. Interest electrically centers in the reasoning, the design, then the construction and installation of modern electrical facilities in such a plant.

President Walther Mathesius of Geneva Steel Co., U. S. Steel subsidiary, which is operating the plant for the government, is emphatic that "everything in the plant has been proved elsewhere. There are no experiments." But it is likewise true that many of the electrical features, although there is precedent for them somewhere else in some other plant, have never before been assembled in such a complete combination to do so much of the control and operation of a large steel plant.

Placed in charge of the project by Columbia Steel Co. and named vice president of the Defense Plant Division was E. M. Barber, mechanical engineer. He gathered together an engineering staff from the United States Steel organization. Electrical engineering was under J. F. Headlee, with Joseph J. Sileck assisting him. Sileck has remained with Geneva Steel Co. to be the operating electrical engineer. The power plant was designed by Sargent & Lundy, Chicago.

The electrical installation was shared by several large contracting companies. A. S. Schulman Electric Co., Chicago, was a prime contractor handling the electrical work in the power house, coke plant, sintering plant, maintenance shop, open hearth substations, administration and sanitary buildings, blast furnaces, ore bedding yards, all the underground 13.8 kv. primary and the overhead wiring for lighting in the plate and slab mill and in the structural mill. This contractor also installed the Westinghouse supervisory control for the plant.

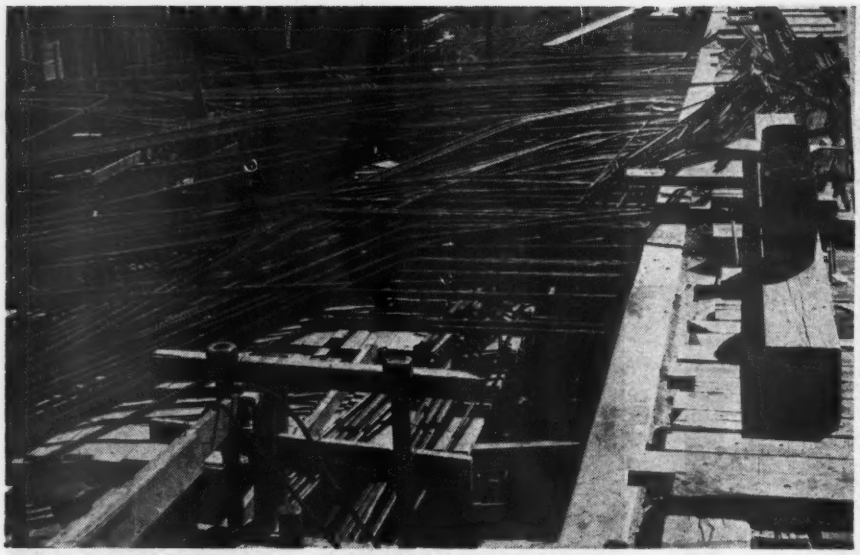
For the slab mill, United Engineering & Foundry Co. was prime contractor and had General Electric Co. as subcontractor, which in turn sublet electrical installation to Dingle-Clark-Comstock Co. of Cleveland and Chicago as co-adventurers. Westinghouse, which supplied the plate mill auxiliary motors and control, sublet to H. P. Foley & Co., Philadelphia. The control houses in the open hearth building were handled by Dingle-Clark as a subcontractor for Amsler-Morton Co. Rust Furnace Co., which built the reheating furnaces in the plate and structural mill, had its electrical work done by Oberg-Capitol, two Salt Lake City electrical contractors. Both Capitol and Peck Electric of Provo did some temporary preliminary construction wiring also.

In designing this new steel plant as nearly to an ideal as wartime restrictions on metals and machinery would permit, several advances in steel mill electrical practice were utilized:

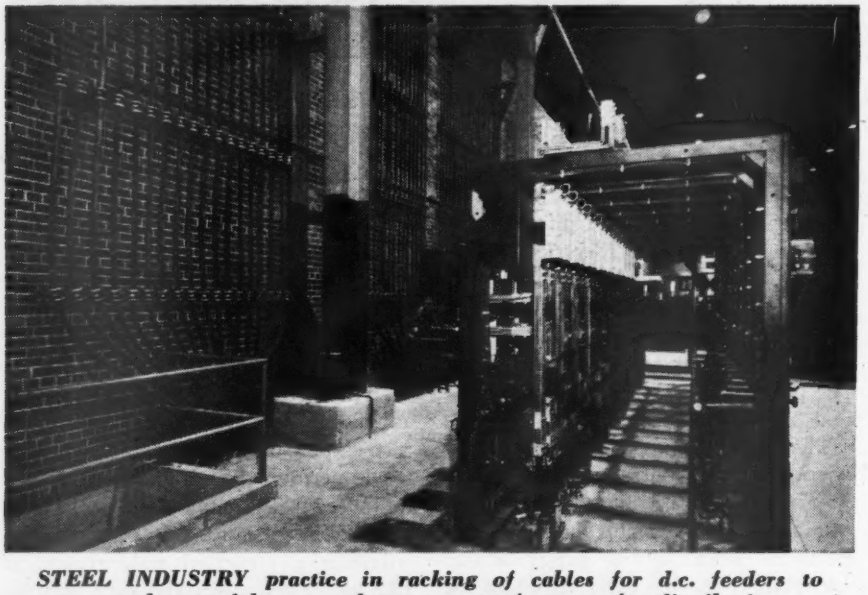
(1) For instance, all primary distribution was carried underground at 13.8 kv. Even street and yard lighting distribution is underground. This obviates any chance of locomotive cranes or other equipment coming in contact with distribution lines. The 13.8 kv. voltage resulted in considerable copper saving, especially with long runs necessitated to cover the wide area of this plant.

(2) Motors, too, for the main drives operate at 13.8 kv., the highest voltage at which steel mill motors have yet been run. (Republic Steel has some at 11,000 volts, the majority use 6600 volts.) The only exception at Geneva is the plate mill designed initially for Bethlehem Steel, which was already equipped with 6,600 volt motors.

(3) Likewise a first, on such a scale, is the total use of supervisory control from the central switch house for the entire plant. This eliminates attendants at the substations. It provides operating advantages by way of cen-



***CONDUIT PLACED** by the contractor in the floor of the powerhouse, prior to concrete pouring.*



***STEEL INDUSTRY** practice in racking of cables for d.c. feeders to cranes and control houses, taken up to roof trusses for distribution.*



***COPPER BUS** from low voltage side of 1,720 kva. Westinghouse rectifier transformer to ignition rectifiers in plate mill motor room basement.*

tralized control and in the greater safety that no important machine will be shut down without its related equipment also being shut down. Central maintenance is also provided for the major equipment.

(4) Placing of substations and arrangement of the flow of materials to best advantage could be planned in advance in this case instead of being fitted in wherever there was space.

(5) Switchgear of one million kva. is new too. All of it at the Geneva plant is of the air blast, air operated type.

(6) All a.c. motors of 200 hp. or less are 440-volt and are of the totally enclosed, fan-cooled, anti-friction type with class B insulation. Larger motors of 2,300 volts have drip-proof frames or drip covers, are anti-friction equipped and wound with class A or boiler-house insulation.

(7) All important units of the power system can be isolated because they are physically separated and switching is provided for by-pass in case of any emergency or trouble. The power company inter-tie substation, the power house, the main switch center building, each of the substations and the motor rooms are all individual.

Distribution System

Loop distribution is used to serve the open-hearth and maintenance shop; sintering and coke plant areas, each with its own substation. Ties can also be made on the secondary side at 2,300 volts. The mills are fed from radial distribution at 13.8 kv. except for the 6,600 volt drives at the plate mill. The underground system is run in Korduct stacked two wide and five high in a bank of ten as a maximum. Where more are required ten-foot centers are maintained between runs of duct. Conductors are lead-covered paper-insulated cables and no conductors are larger than 350,000 cir. mil in order to reduce reactive losses. Cables are three-conductor cables. Where more capacity is needed the cables are run in multiple.

Where ducts cross under roadways a ventilating duct is laid over the others, the grade of the ducts being given a slight incline, thus providing a natural ventilation. Runs between manholes have a maximum length of 500 ft. and all manholes are drained.

A complete grounding network is maintained over the entire plant area. To it all a.c. machinery, all d.c. machinery, all building frames and the switchgear and metal equipment of any type is bonded. Grounds consist of

ground rods driven to water table and into it at least a depth of 4 ft., with a maximum resistance of .05 ohms.

Two types of substations are used, one a totally enclosed one, the second in which transformers are located outside. The totally enclosed substation is used in the sintering area where fine iron ore dust in the air makes it desirable to keep the substation under cover. In others, where only a slight amount of graphite may be encountered in the air, complete coverage was deemed unnecessary, and here the transformers are located outside near the substation house. The 13.8 kv. comes underground to the substation in cable to the switchgear and transformers. From the transformers a short bus run is made to rectifiers or other equipment as required.

Control Wiring

The major part of the control wiring is run in lead-covered cable. Between units it is run in a separate duct system. In the switchhouse control room it is brought in to a pan or duct located under the floor below the control board. Where conduit enters the control house it comes up in a stack. Conduit terminators are used at the end of all conduits and all lead cables are sealed.

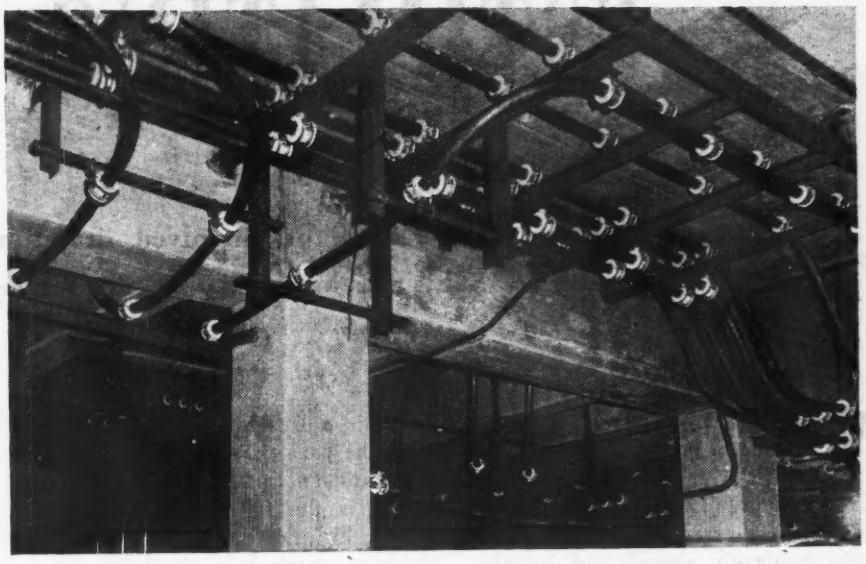
All control panels for the auxiliaries and other motors were factory assembled and moved to the job ready to be set up. A pull box was cast at the bottom of the panel location and a trench placed alongside it. This trench is covered with a steel plate which is removable for accessibility.

Every control room overlooks the area controlled from it. This gives those handling maintenance a better opportunity to check their work. Control room housings are equipped with louvers at top and bottom for ventilation. Where resistors are used an effort is made to keep the temperature uniform in order to maintain resistance value the same the year round.

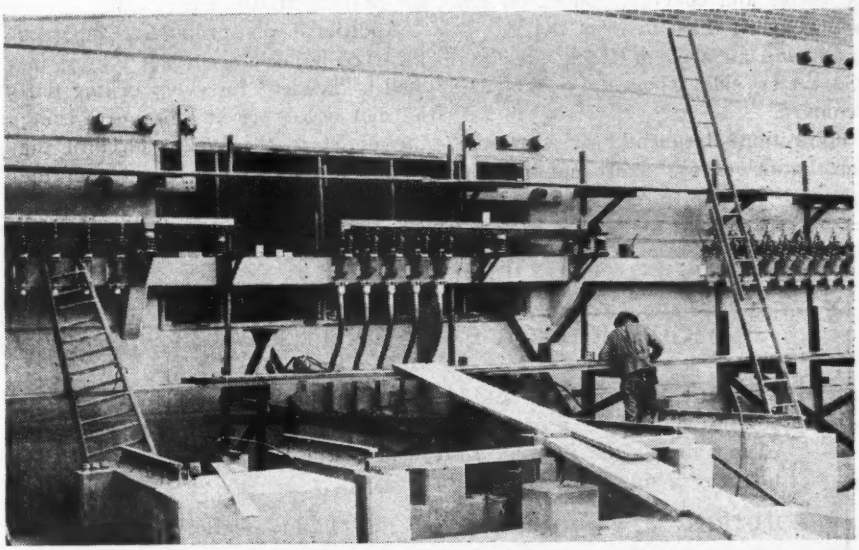
Voltages for auxiliary equipment are 230 volts d.c. and 440 volts a.c. However none of the control pushbuttons for 440 volt equipment are operated at over 110 volts.

Beside the control wiring, extensive intercommunication and signal systems are maintained. These are run in a separate duct system of their own. They include the Bell telephone connections throughout the plant, local telephones and a carrier current telephone line connected with the power company. In addition to this a supervisory telephone circuit is carried to each major unit for communication with

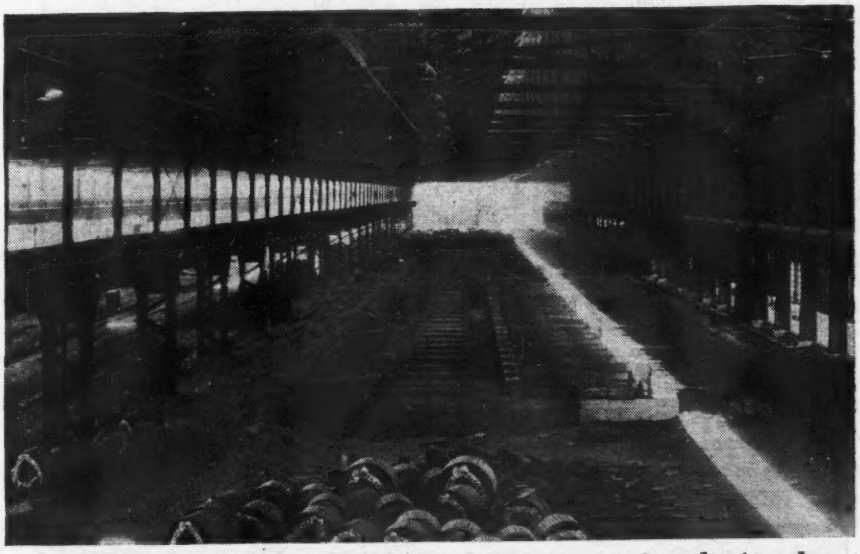
[Continued on page 103]



***OVERHEAD CABLE** racking in basement of plate mill motor room eliminates conduit. Maximum size conductors are 350,000 cir. mil.*



***CONNECTING SECONDARY** buses of the transformers inside a bus housing at one of the substations.*



***PORTION OF PLATE** mill building during construction showing the mounting of Millite 1,000-watt lighting units to the roof chords.*

ESTIMATING Conduit

The evaluation of factors involved in estimating conduit installations is continued in this article where pan, tile arch and exposed work are reviewed.

VARYING from the flat slab, discussed in a previous article in the August 1944 issue of *Electrical Contracting*, "pan" and "tile arch" are two other types of concrete construction frequently encountered by electrical estimators. Here inverted metal pans or concrete tile sections are set on forms and concrete poured on top and between them to form the slab—producing an arch or block effect on the under side when the forms are removed.

Objections frequently arise to the installation of too many conduits in the thin (usually 3-inches) concrete over the pans. The concrete between the pans (normally 10- to 12-inches deep) is the full depth of the slab (about 15 inches). In numerous cases conduits, particularly the larger ones, must be installed in this "deep" space. This requires extra 90 degree bends in the branch circuit runs.

Additional non-productive labor is incurred because a carpenter must install a "header" for every ceiling outlet, not occurring in a beam, to bring the outlet to the lowest level of the pour. Conduits, if installed over the pans, will hook down into the outlet box. If installed along the beams, conduits normally require an offset at the outlet box.

Since labor problems in pan and tile arch construction are so similar, the labor units in Table I apply to both types of construction. Sometimes, however, the ceilings are suspended and the conduits installed in the intervening space.

Figure 1

FIGURING HIGH BAY CONDUIT WORK

PROBLEM—What labor should be figured for an installation of conduit submain and branch circuits mounted exposed on wood, 20 feet above the floor in a large area building? No machines yet set nor any floor obstructions.

SOLUTION—It was decided to use four rolling scaffolds (13-ft., 6-in. high) in close proximity to each other—one for the submain work and three for the branch circuits.

A crew of seven men was to be allocated to this work—two "ground" men to supply and push the scaffolds; two "top-side" men on the submain scaffold; and one "top-side" man on each of the three branch circuit scaffolds.

Non-productive Labor

Submain—It was estimated one ground man, devoting half his time could supply the two "top-side" men and move the scaffold—meaning four non-productive man hours for each 16 productive ones. This would mean **adding 25** percent to the basic labor unit. If **ladder** were used, the basic labor unit would have to be **raised 40 percent.** Of course, rental or cost charge on the scaffolds must be entered as a job cost.

Branch Circuits—It was estimated that one man, devoting all his time could supply and move two scaffolds—meaning eight non-productive man hours for each 16 productive ones, or **a 50 percent addition** to the basic labor unit. Normally, this **can be reduced to 25 percent** by having the "ground" man **do such productive work** as wiring and assembling fixtures, cutting and threading conduit, etc.

Conduit Work in Partitions

The units heretofore quoted drew no distinction as to the type of construction into which the conduit passed after leaving the slab. The outlet designation was applied to the wiring device in connection with a slab job and no consideration was given the various installation problems relating to the complete wiring installation.

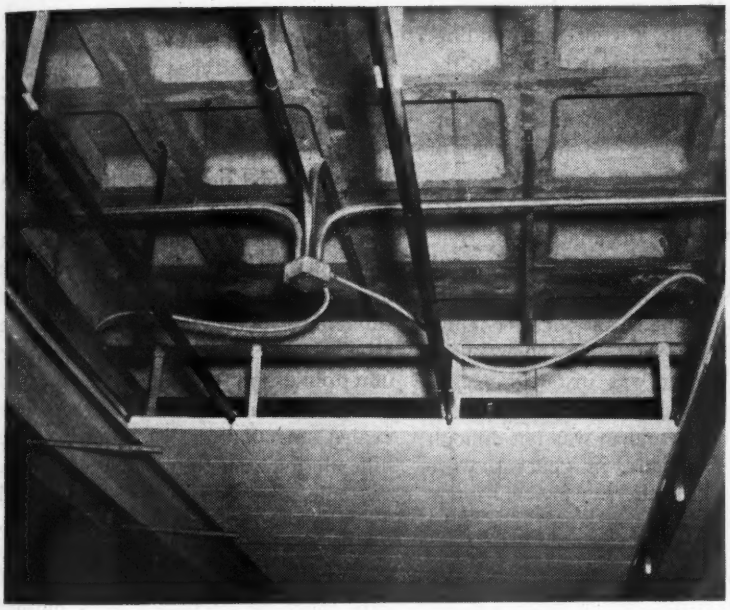
Brick or Glazed Tile Partitions—A careful analysis of the labor problems involved reveal that they are essentially typical and for estimating purposes identical labor units can be used.

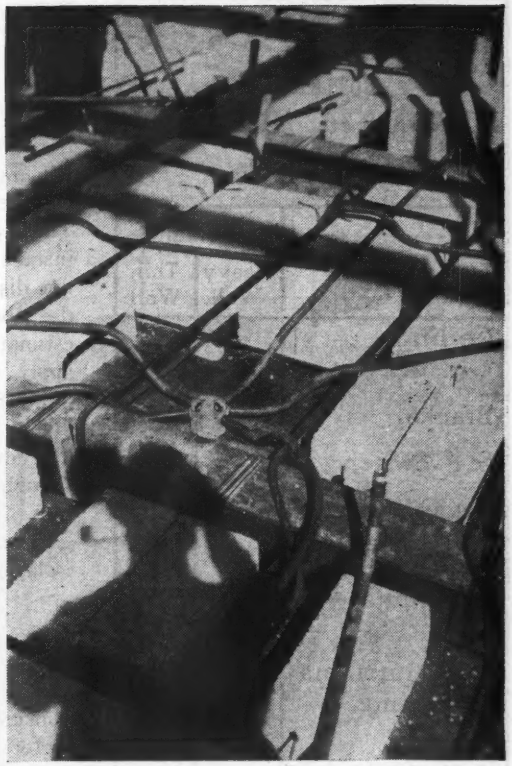
After the forms or pans have been removed, the electricians need not wait for the partitions to be built. The conduit hook protruding from the slab is rigid enough to support the weight of the conduit nipple and the outlet box extended to the recommended height. Horizontal conduit runs in the partition line can be installed prior to the partition construction. Conduits should not be laid on the floor in the partition lines as they will interfere with the setting of "plates" when a stud partition is used, or hamper masonry work. The usual method is to lay the conduit in a mortared joint, or notch the studs where the wood construction is used.

From this brief outline the similarity of the operations can be seen. The installation in brick walls, etc., involving a small proportion of productive labor in comparison with the total labor hours involved, should not be confused

Work . . Part 2

By Leo W. Witz
Continental Electrical Construction Co.
Chicago, Illinois





***AN OFFSET** for each outlet box terminal is required in this modified tile arch job. All these must be considered in estimating this type of installation.*

***CONDUIT SYSTEMS** are frequently run exposed in a suspended ceiling area—particularly in "pan" and tile arch construction—requiring scaffold or ladder work.*

with the very productive operation under discussion. In such labor jobs, where an estimator can foresee the necessity for maintaining mechanics on a job as certain walls with small amounts of conduit installed are built, it is necessary to segregate that particular labor job and assign different units to it.

Labor problems for conduits in clay tile or macolite partitions are virtually the same as in the glazed tile or brick. The labor job parallels the type previously outlined and the same unit is applied based on the fact that the outlet is installed out of a concrete slab. In analysis the outlet installation is a two-fold operation on the rough-in portion. This is inherent to concrete construction and our outlet labor units are established in accordance with the general construction of the building. In short, if you are in the process of estimating a concrete job, the labor units applied to the outlets will be grouped under a heading applying to the job in general. This will minimize the estimating problem as all applicable units will be grouped.

Concrete Walls or Columns—In dealing with this type of construction we find entirely different installation problems. However, certain compensating factors adjust the labor involved so that the same unit previously established can apply to this type of outlet installation.

The installation of wiring device outlets in a wall which is to be poured involves the following operations:

1. Deliver and layout of materials.
2. Spot outlet location.
3. Fasten box on the conduit.
4. Install the "plaster cover" on the box.
5. Loop a piece of tie wire through the back mounting holes of the box and extend it through the box opening.
6. Stuff the box with paper.
7. Fabricate one conduit hook where conduit leaves the wall and projects into slab.
8. Fabricate one conduit offset near the box.
9. Drill a hole in the form, centered at the outlet location.
10. Drop the conduit and box between the forms, and fish the box tie wire through the hole in the form.
11. Draw the box tight to the form by twisting a rod through the wire loop—tourniquet fashion.
12. Block conduit away from form by fastening conduit at top.

These are all pre-pour operations. Boxes must be drawn tightly to the form to assure a flush outlet when forms are removed. The conduit offset is necessary to permit concrete flow completely around the conduit.

After removal of the forms, the following operations are necessary:

1. Clean out the outlet.
2. Extend the conduit hook, previously installed from the wall into the slab, to its outlet in the slab.
3. Make one branch circuit conduit terminal. (At ceiling outlet).
4. Make one branch circuit offset. (At ceiling outlet).
5. Install wiring device complete.

The labor items regarding an outlet installation at no time consider the straight conduit work. As mentioned before, the overall conduit quantities are estimated as straight runs.

Although the job problem is entirely different, the outlet is considerably

Table I

OUTLETS IN PAN AND TILE ARCH WORK

Man Hours Each

Type of Outlet	Conduit	
	Heavy Wall	Thin Wall
Ceiling—4-in. oct.	0.65	0.45
Bracket	0.60	0.40
S. P. Switch	0.75	0.55
3-way Switch	0.85	0.65
4-way Switch	0.85	0.65
Junctions—4-in.	0.65	0.45
11-B junctions or ceiling boxes	0.75	0.55
Adj. floor outlets	1.30	1.10
Telephone floor outlets	1.15	0.95

Note: Above units, also typical for flat slab construction, include labor for two cuts, threads and conduit offsets (at wall outlet and ceiling junction) for two terminals; also installation of wiring device.

Table II

LABOR INCREASE DUE TO WORKING HEIGHT

Working Height	Size Ladder Used	Increased Labor—percent
12 ft.	8- or 10-ft.	—
13 ft.	10-ft.	5
14 ft.	10- or 12-ft.	10
15 ft.	12-ft.	15
16 ft.	12- or 14-ft.	20
17 ft.	14-ft.	25
18 ft.	14- or 16-ft.	30
19 ft.	16-ft.	35
20 ft.	16-ft.	40
Above 20 ft.	Use Scaffolds	Varies with number of scaffolds and men needed

easier to "spot"; the conduit hook projecting into the slab can normally be the balance of the length the mechanic is working on, thus eliminating an additional cut and thread. Generally the slab has been formed prior to the pouring of columns and the rough job can be completed in one operation. These factors adjust the more difficult installation, so that it would be rather fine distinction to differentiate between the labor units. Thus, to simplify the estimating problem, the same unit will apply.

So far the discussion has covered "mud" work in a concrete building. The units, in general, pertained to the "rough" portion of the job. The insertion of "trim" items pertaining to outlet installation were for the purpose of isolating the outlet as a unit.

Exposed Installations

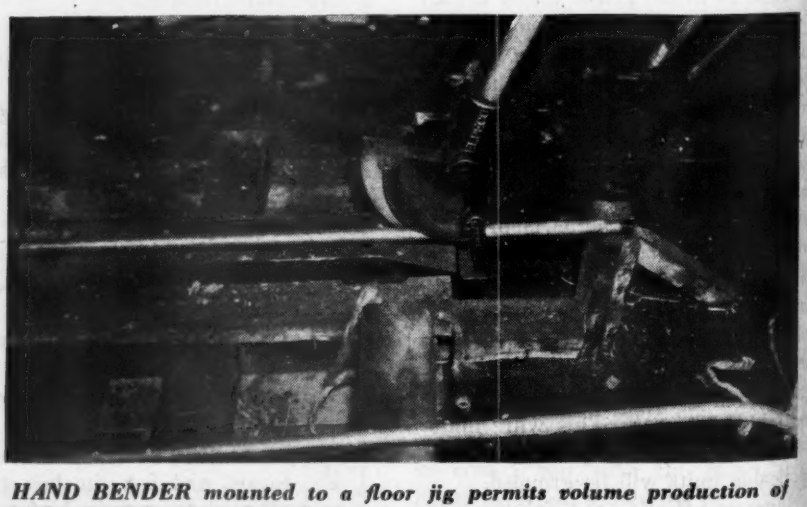
The installations previously under consideration had an ideal conduit factor, and a relatively poor outlet factor. Conduit was installed on the "deck", and no ladders were required. The fastening problem was not difficult and job conditions, in general, were favorable since there were no intervening partitions or obstructions. The outlets on the deck were also installed under favorable conditions, but they required non-productive labor (observation) during the concrete pour. They required cleaning out work done on ladders, etc., and any minor deviations in spotting, etc., required an expensive adjustment. Outlets stubbed down out of the slab involved two separate operations, and there was considerable labor involved in the "nippling out" process.

In exposed work the outlets are installed under more favorable conditions, but the conduit installation requires the use of ladders. The labor units for this type of construction are based on the labor being performed not over 12 ft. above the floor line. Additions to these units for variances in height will be discussed later. Conduit, as always, will be considered on a "straight run" basis. The only additional problems involve the hoisting and fastening of materials. Such special labor as notching joists, channeling construction, etc., will have separate units.

The conduit, eventually concealed in some cases, is fastened to the construction when the building is in an open state. Certain types of installations, therefore, can be grouped for labor unit purposes. It makes little difference if conduits are being installed on exposed wood joists or those which are to be furred down and covered. The mounting technique is typical, but larger quantities of conduit may be used on an exposed system since the runs must parallel the walls for the sake of appearance. The same labor unit applies, but the quantity is greater.

Outlet work on the average concealed installation is slightly more difficult than on the open type of job. In some cases outlets must be centered in squares which form a ceiling design. The outlet must be brought flush with the plaster line, and a higher degree of care must be exercised on a finished job. Specially designed box mountings, now available with proper offsets and boxes of various depth, facilitate this work and reduce errors. The labor units in Tables III and IV apply to both concealed or open construction surface mounted conduits. Exposed work will require more bends etc., but the same basic units apply.

The estimator should determine items of special labor which apply to the job he is figuring. Special units



***HAND BENDER** mounted to a floor jig permits volume production of right angle bends in branch circuit conduits.*

required for specific tasks such as channeling, notching, holes in walls, job transportation of materials etc., must be applied as needed.

The straight run conduit labor units include fastening to the construction. Only when conduits have special supports is fastening deleted from the units. When conduits are installed in racks previously mounted, the installation of the racks is considered a separate labor job. In the branch circuit units to follow, it will not be necessary to allocate special units for general fastening. Determine the type of building construction on which you will work and apply the one labor unit.

The variances between the units reflect the additional difficulty of one job, as against another, because of the different fastening labor. The labor unit for conduit installed on concrete covers also the labor for installing an expansion shield every seven feet of the branch circuit run. Similarly, the labor unit for conduit exposed on clay tile covers inserting toggle bolts, etc. Where certain grouped installations have no apparent inter-relation it is because the overall labor units were so closely paralleled that for simplicity, the same unit applies to the several types of the installations. Although there may seem to be an apparent inconsistency concerning certain units, careful rechecks have confirmed values. A conduit run on clay tile requires toggle bolts; on a brick wall, expansion shields. Normally, toggle bolts can be installed considerably faster than expansion shields, but frequent checks have proven that, in many cases, special washers or bolts completely through the tile are required. The overall labor will closely approximate the "on brick" schedule.

Additions to Conduit Labor

The discussion has been confined to branch circuiting except for generalities which apply to all conduit installations. In the installation of branch circuit conduits the labor variations from "straight run" units have been absorbed at the outlets. Where any conduit, regardless of its size, is run from one point to another, care must be exercised to include these additions to the conduit labor. On any conduit run not directly connected with outlet installation, such additions must be anticipated and entered.

In general, the additional conduit labor will consist of:

1. Terminals.
2. Elbow and Couplings.
3. Field bends. (Hand tools and hydraulic tools)
4. Nipples. (Made in the field)
5. Nipples. (Ordered and made to length)

A Conduit Terminal consists of a cut, thread, the attendant measuring, and the fastening of the conduit to a box, cabinet, etc. Such special labor as cutting field knockouts, removal of panel sides, etc., is not included. There will be one terminal wherever a conduit *either enters or leaves an enclosure.* A terminal would occur wherever there is a locknut and a bushing, or a thinwall connector. In general, the terminal labor could be applied to these material items, except that on power installations, double locknuts are used.

Table III

SURFACE MOUNTED CONDUIT—STRAIGHT RUN

Man Hours Per 100 Feet

Conduit Size	Type of Construction						
	A	B	C	D	E	F	G
Branch Circuits							
1/2-inch	2.5	3.3	4.3	4.7	6.0	7.0	2.2
3/4-inch	3.0	4.2	5.2	5.7	7.7	9.0	3.0
1-inch	4.5	5.5	6.3	7.0	9.0	10.5	3.5
Feeders							
1 1/4-inch	5.5	6.7	7.6	8.4	10.5	12.5	4.5
1 1/2-inch	7.0	8.0	9.0	10.0	13.0	15.5	6.5
2-inch	9.0	10.5	12.0	13.2	15.5	18.5	8.5
2 1/2-inch	12.0	13.5	15.0	16.5	20.0	24.0	10.0
3-inch	15.0	17.3	19.0	21.0	25.0	28.0	12.0
3 1/2-inch	17.0	19.2	21.0	23.0	27.0	32.0	14.0
4-inch	20.0	23.0	25.5	28.0	32.0	37.0	16.0

Legend:

A—IN FLOOR FORMS: in racks under 12 ft. (no labor for racks included).

B—WOOD CONSTRUCTION.

C—BRICK CONSTRUCTION (On wood construction with brick walls figure circuits from ceiling to outlet under "B" and figure outlets under "on brick".)

D—ON CONCRETE OR STEEL—contemplated drilling steel. Where beam clamps are used, add for beam clamps and use column "A".

E—SIDE WALLS BEING POURED—brick walls with concealed horizontal or short vertical runs. (Requires presence of mechanics with small proportionate installation).

F—VERTICAL RISERS for short vertical services, etc., requiring extensive checking and planning. Long risers involving considerable installation cost should be considered as a separate item.

G—OPEN TRENCH—no labor included for trench.

Notes:

DIRECT MOUNTING—Above units are based on fastening conduit direct to building construction and do not apply to suspended work where special hangers are needed. This problem together with parallel conduits will be covered in a subsequent table.

HEIGHT FACTOR—For installations over 12 feet in height, add 5% to applied units for each additional foot of height. Where height prohibits use of ladders, figure scaffolds.

Table IV

ADDITIONS TO "STRAIGHT RUN" CONDUIT LABOR

Man Hours Each

Conduit Size	TERMINALS H.W.	TERMINALS T.W.	ELBOWS H.W.	ELBOWS T.W.	FIELD BENDS H.W.	FIELD BENDS T.W.	JOB NIPPLES H.W.	JOB NIPPLES T.W.	Mfg. Nipples H.W.
½-inch	0.15	0.10			0.08	0.04	0.20	0.15	0.15
¾-inch	0.20	0.15			0.10	0.05	0.30	0.20	0.20
1-inch	0.30	0.20	0.25	0.15	0.40	0.15	0.35	0.25	0.25
1¼-inch	0.40	0.25	0.35	0.20	0.75	0.70	0.50	0.30	0.35
1½-inch	0.55	0.30	0.50	0.25	0.85	0.70	0.65	0.35	0.40
2-inch	0.80	0.35	0.70	0.30	1.00	0.75	1.00	0.40	0.45
2½-inch	1.20		1.00		1.25		1.50		0.50
3-inch	1.75		1.40		1.50		2.50		0.75
3½-inch	2.50		2.00		1.75		3.50		0.90
4-inch	3.25		2.50		2.00		4.50		1.00

Legend:

H.W.—Heavy wall conduit.

T.W.—Thinwall conduit.

TERMINAL—Any point where a conduit enters an enclosure.

ELBOW—A manufactured elbow completely installed.

FIELD BEND—Bends made in the field. Up to 1-inch use hand tools; over 1-inch use hydraulic bender. Deduct 20% for additional bends of same size made on the hydraulic bender.

JOB NIPPLE—Nipples cut and threaded on job and completely installed, exclusive of special labor such as cutting knock-outs, etc.

MFG. NIPPLE—Installation of nipple ordered made to specified length.

Note: Use units for ½ to 1 in. conduit inclusive **only when outlet unit does not cover this additional labor.**

The estimator may apply the labor unit to the bushing on conduit work; to the connector on thinwall conduit work, or consider terminals under "special labor" as illustrated in Table IV.

Elbows and Couplings are considered as one unit, the additional coupling applying to the elbow only. The couplings for the conduit runs are included in the "straight run" labor. An elbow installation involves cutting the conduit where the elbow occurs and the additional labor to fasten it to the construction. This refers to a manufactured elbow and is not to be confused with field bends.

Field Bends are changes in direction of the straight run conduit made at the job. In general, up to ¾-in. heavy wall and up to 1-in. thinwall bends are done with hand tools, or a bending block. Above these sizes it is advantageous to use hydraulic tools. The labor units are formulated on this basis, with a twilight zone on the sizes of heavy wall from 1-in. to 1½ in. which some times can be formed on the job without hydraulic tools. Attempted field bends on 1¼-in. to 2-in. thinwall without using a special hydraulic bender and shoe generally produces "kinks" in the arc of the bend.

Field Nipples involve measuring, cutting, threading, and installing the nipple from one enclosure to another. This labor unit applies only to the short conduit extensions (not exceeding three feet in length) from box to box. It does not include special labor for cutting knock-outs, removing existing cabinet interiors to provide working access and other special tasks.

Manufactured Nipples involve the same problems, except they are ordered to length and do not have to be made up (cut and threaded) in the field.

It is important to remember that these additions to "straight run" labor do not apply to the branch circuiting, as all of these items are included in the outlet units.

The Height Factor

The height at which material is installed has an important bearing upon the labor involved. The standard units in Tables III and IV are based upon normal working conditions and a working height of not over 12 ft. above the floor line. There actually is a negligible difference, however, between working heights of 8 or 10 feet as

[Continued on page 173]



***ROLLING WORKSHOP** on this scaffold cuts "ground" man's non-productive labor to a minimum—an important factor in figuring scaffold work*



NECA to Meet in French Lick

Annual conference sessions scheduled October 1 to 5. Cooperation for 1945 work to be major theme. Speakers to include leaders from all branches of the electrical industry. Postwar plans to be discussed.

THE National Electrical Contractors Association will meet in French Lick, Indiana, October 1 to 5. Theme of the meeting program will be "1945 work" and speakers will discuss the efforts of all branches of the electrical industry toward increasing business opportunities for all in the year ahead.

The full convention schedule will cover eight days although the Annual Meeting will occupy only four days from Monday through Thursday. Board of Governors and committee sessions will precede and follow the general sessions.

The program outline is as follows:

Sept. 30, Saturday, Meeting of present Executive Committee

Oct. 1, Sunday, Meeting of new Board of Governors

Oct. 2, Monday, Morning Program Session

Oct. 3, Tuesday, Morning Program Session

Oct. 4, Wednesday, Morning Program Session

Oct. 5, Thursday, Morning Business Session and Election

Oct. 6, Friday, Board of Governors Meeting

Oct. 7, Saturday, Meeting of Administrative Committee

This year the National Electrical Contractors Association returns to its former practice of holding its business meetings in the morning on an extended schedule with afternoons free for recreation and relaxation. The French Lick Springs Hotel in the Indiana foothills was selected as the meeting place because of its excellent convention facilities combined with unrivaled opportunities for rest and relaxation. There are complete facilities for vacation pleasures including an 18-hole golf course and a stable of fine saddle horses. French Lick Springs is located in Southern Indiana, 58 miles northwest of Louisville, 110 miles south of Indianapolis and 153 miles southwest of Chicago.

Transportation should be arranged in advance. There is direct overnight pullman service daily between Chicago and French Lick over the Monon Railroad. From the East, the Baltimore and Ohio Railroad furnishes the best transportation via Cincinnati to Mitchell, Indiana with regular bus connection or hotel taxi service over the 22 miles from Mitchell to French Lick. From the West, connection may be made at St. Louis for the B. & O. to Mitchell. There are also three Greyhound buses daily from Louisville.

OUTDOOR SERIES

Industrial protective lighting and airport systems are growing uses for the series lighting circuit. This article discusses the circuit, its apparatus and its care and maintenance.

Chart A
TROUBLE SHOOTING

Trouble	Possible Cause
Lamps fail to burn, even dimly	Primary oil switch may not be on. Pilot circuit may be faulted. Time clock may have failed. Operating mechanism of primary oil switch may be out of order. Primary fuse cutout may have dropped out. Primary lead may be open.
Lamps burn, but dimly	Regulator may be overloaded. Secondary connection may be poor. Poor cable insulation may cause leakage to ground. Regulator moving mechanism may be out of order.
Lamps burn at normal brilliancy except one or two which burn dimly	Film cutout may have partially failed. Voltage may be leaking to ground. There may be a breakdown in the isolating transformer. Lamp may not be correct size. Lamp may be near the end of its life.
Film cutout fails but lamp is not burned out	Improper cutout may have been used. Abnormal line surges may have occurred. Lamp may be loose in socket.
If water gets into fixture	Bracket threads may not be properly red leaded. Joints may not be properly gasketed.
Abnormal breakage of glassware	Fixture may be over-lamped. Holder may not accommodate glassware properly. Glassware may not be for that particular fixture. External vibration may be abnormal. Damage may be due to external causes beyond control.
Sockets and receptacles are burned and pitted	Connections may not be tight. Cutout may not break down completely. Voltage may leak across socket. Socket may not fit receptacle properly. Lamp may not make contact in socket.
Abnormal deterioration of metal parts	Atmosphere may contain gases or vapors that attack metals.

LIGHTING equipment and apparatus for series lighting are designed to give many years of dependable service when properly operated and systematically maintained. A better understanding of the purpose and performance of the elements that comprise the system make both of these functions easier.

Series Circuits

A series circuit differs from the common multiple circuit in that the lamps are connected in series with a single wire. Whereas in a multiple circuit the lamps are connected between two conductors. Another major difference between series circuits and multiple circuits is the voltage. In a series circuit the voltage across a single lamp is very low, but the load circuit voltage is equal to the sum of the voltage of all lamps in the circuit (single lamp voltage times number of lamps). For example, a 6,000 lumen 6.6 ampere series lamp is rated at 49.9 volts. If the circuit contains 60 lamps, then the load voltage is 49.9 times 60, or 2,994 volts. To this must be added certain losses. The regulator loss (Table A) is on the order of 5 to 10 percent and the line loss on the order of 6 to 7 percent. The load voltage is therefore increased 5 percent of 2,994 and 7 percent of 2,994 or 360 volts. This brings the supply voltage to 3,354 volts.

Due to the internal reactance in a regulator the open circuit voltage will be on the order of 25 percent more than the normal secondary load voltage. Therefore the "live" metal parts of a fixture are insulated to withstand this condition. This is termed "flashover" or "creepage".

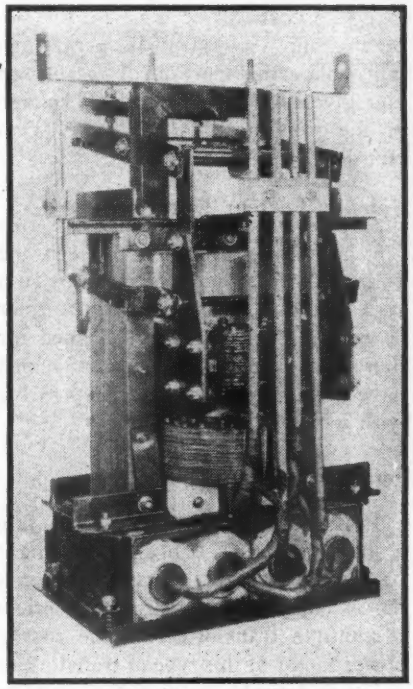
Constant Current Regulators

Regulators are used to maintain a constant current on a series lighting circuit under all conditions of load. Constant current is maintained by auto-

LIGHTING

By E. B. Karns,
Manager
Street, Aviation and Marine Lighting Application Dept.
Westinghouse Elec. & Mfg. Company

matically varying the air gap between the primary and secondary coils. The secondary coil is mounted on a lever arrangement so it will move up and down to adjust current to load conditions. Outdoor regulators are similar in appearance to conventional distribution transformers and are usually mounted on poles near the lighting circuits which they energize. They should always be properly protected. Relays are essential for disconnecting the primary should an open circuit fault occur on the secondary. Lightning arresters, and primary cutouts are always a good investment. Construction of a regulator is illustrated in Fig. 1 and the electrical characteristics of a pole type regulator are shown in Table A.



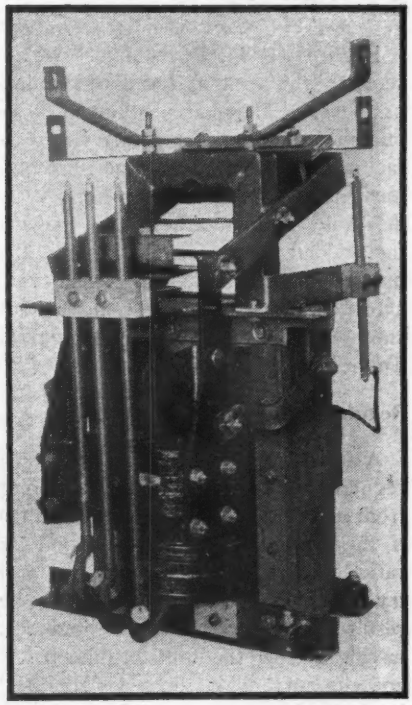


FIG. 1 Constant current regulator with case removed, the upper coil moves to automatically adjust the current.

FIG. 2 High power factor regulators are equipped with built in capacitors connected in the primary circuit.

Table A

TYPICAL CHARACTERISTICS OF STANDARD CONSTANT CURRENT REGULATOR

Rating KW	Approx. Net Wt., Lbs. Gal. Oil	Less Oil	Incl. Oil	Primary Amps at all Loads	Kv-a. Input at all Loads	Secondary Open Circuit Voltage	Normal Secondary Load Voltage	(C) Efficiency Full Load	¾ Load	½ Load	¼ Load	Primary Power Factor Full Load	¾ Load	½ Load	¼ Load
6.6-Ampere Secondary, 60 Cycles, Primary 2400 Volts (With 2160-Volt Tap)															
2	34	300	550	1.24	2.98	430	303	89.4	86.3	80.7	67.8	75	56	38	20
3	34	335	585	1.82	4.37	660	455	91.6	89.1	84.6	73.2	75	56	38	20
5	34	370	620	2.98	7.15	1080	758	93.2	91.2	87.2	77.3	75	56	38	20
7-½	41	445	745	4.42	10.6	1600	1135	94.2	92.2	88.8	79.8	75	56	38	20
10	41	475	775	5.87	14.1	2090	1515	94.7	93.1	90.0	81.8	75	56	38	20
15	51	560	940	8.75	21.0	3090	2270	95.4	93.9	91.3	83.9	75	56	38	20
20	51	620	1000	11.6	27.8	4090	3030	95.8	94.6	92.1	85.5	75	56	38	20
25	74	825	1380	14.4	34.6	5110	3790	96.3	95.2	93.0	86.9	75	56	38	20
30	74	875	1430	17.3	41.5	6130	4550	96.5	95.4	93.3	87.3	75	56	38	20
20-Ampere Secondary, 60 Cycles, Primary 2400 Volts (With 2160-Volt Tap)															
2	34	300	550	1.24	2.98	142	100	89.4	86.3	80.7	67.8	75	56	38	20
3	34	335	585	1.82	4.37	218	150	91.6	89.1	84.6	73.2	75	56	38	20
5	34	370	620	2.98	7.15	356	250	93.2	91.2	87.2	77.3	75	56	38	20
7-½	41	445	745	4.42	10.6	528	375	94.2	92.2	88.8	79.8	75	56	38	20
10	41	475	775	5.87	14.1	690	500	94.7	93.1	90.0	81.8	75	56	38	20
15	51	560	940	8.75	21.0	1020	750	95.4	93.9	91.3	83.9	75	56	38	20
20	51	620	1000	11.6	27.8	1350	1000	95.8	94.6	92.1	85.5	75	56	38	20
25	74	825	1380	14.4	34.6	1690	1250	96.3	95.2	93.0	86.9	75	56	38	20
30	74	875	1430	17.3	41.5	2020	1500	96.5	95.4	93.3	87.3	75	56	38	20

High Power-Factor Constant Current Regulators

High-power-factor regulators are essentially the same as standard regulators except they are equipped with built-in capacitors for primary power-factor correction. This type is recommended on installations where it is desirable to maintain a high power-factor load and minimum kva. on the primary line. (Fig. 2) Electrical characteristics of a high-power factor constant current regulator are shown in Table B.

Regulator Load

A small overload does not injure a regulator. However, full light output from the lamps will not be obtained if the regulator is loaded beyond its rated capacity. The moving coil will try to adjust for overload and as the result the two coils will be together, having reached the limits of their travel and the current on the secondary will begin to drop. As a result the lamps will be dim. Table C gives the number of lamps recommended for a given size regulator.

Control

It is desirable to use primary control on constant current regulators so the unit will not be on the line when the lights are off. The control should be in the form of an oil switch either manually operated, remote controlled by a pilot circuit, or automatically controlled by a time clock. Fig. 3, shows a series circuit remote controlled by a pilot circuit. Fig. 4, a time clock control, and Fig. 5 cascaded series circuits where the operating coil of a primary oil switch is placed in a preceding series circuit so that by controlling one series circuit a number of additional circuits may be energized.

Group Series Circuits

On a series system it may be desirable to keep the voltage down on a portion of the circuit, such as on a bridge. This can be done by the use of a group series transformer which will isolate that portion of the circuit and give low open secondary voltage on the group series transformer (Circuit diagram shown in Fig. 6).

Isolating Current Transformers

Where it is desirable to keep the voltage down on individual lamps on a series circuit, an isolating transformer is used. This usually is designed for individual lamp operation and must have a rating equal to the lamp rating with which it is to be used.

Series Multiple Circuits

It is sometimes desirable to operate a multiple lamp, such as a floodlight or a warning light, from a series circuit. This is done by use of a series-to-multiple transformer. Due to the power factor of this type of transformer it is not desirable to operate a number of such transformers on a series circuit. Before adding to a given circuit the primary input of the series multiple transformer should be checked with the manufacturer and a check of the present loading on the regulator to determine if additional load can be added to the circuit.

Film Cutouts

A film cutout is the "fuse" of a series circuit. It is mounted in the socket and is parallel with the lamp. The rating of the cutout depends upon the lamp used. Its rating for minimum breakdown is always in excess of the operating voltage of the lamp. So as long as the lamp burns the cutout acts as an insulator between the socket prongs. But when the filament of the lamp fails there is an open circuit on the secondary of the regulator, and a rise in voltage. If the circuit remained open the maximum voltage reached would be the open circuit voltage of the regulator in use. However, the film cutout serves to restore the circuit after lamp failure by short circuiting the prongs of the socket. Therefore the film cutout is a small but very important part of a series circuit. It should operate in two to three cycles after the lamp filament opens, thus preventing high voltage rise on the circuit. Its operation is the reverse of a fuse. That is, it limits the voltage (not current), breaks down and becomes a conductor of electricity when its breakdown voltage is applied.

The film cutout should, when broken down, make a solid connection with no arcing. If there is arcing much damage can be caused. Arcing results in heating which in time burns up the socket and receptacle. It also causes radio interference.

Care and Maintenance of Outdoor Equipment

A program of complete inspection and systematic maintenance provides better performance and greater effi-

Table B

TYPICAL CHARACTERISTICS OF HIGH POWER-FACTOR CONSTANT CURRENT REGULATORS

6.6-Ampere Secondary, 60 Cycles, Primary 2400 Volts (With 2160-Volt Tap)

Rating KW	Approx. Net Wt., Lbs. Gal. Oil	Approx. Net Wt., Lbs. Less Oil	Approx. Net Wt., Lbs. Incl. Oil	Approx. Primary Amps at Full Load	Approx. Kv-a. Input at Full Load	Secondary Open Circuit Voltage	Normal Secondary Load Voltage	(C) Efficiency Full Load	(C) Efficiency ¾ Load	(C) Efficiency ½ Load	(C) Efficiency ¼ Load	Primary Power Factor Full Load	Primary Power Factor ¾ Lg.	Primary Power Factor ½ Lg.	Primary Power Factor ¼ Lg.
2	38	375	660	0.94	2.26	430	303	89.4	86.3	80.7	67.8	99	98	90	65
3	38	410	695	1.38	3.31	660	455	91.6	89.1	84.6	73.2	99	98	90	65
5	38	445	730	2.26	5.41	1080	758	93.2	91.2	87.2	77.3	99	98	90	65
7-½	47	545	895	3.36	8.05	1600	1135	94.2	92.2	88.8	79.8	99	98	90	65
10	47	580	930	4.44	10.65	2090	1515	94.7	93.1	90.0	81.8	99	98	90	65
15	59	660	1100	6.63	15.90	3090	2270	95.4	93.9	91.3	83.9	99	98	90	65
20	56	760	1180	8.80	21.10	4090	3030	95.8	94.6	92.1	85.5	99	98	90	65
25	82	1030	1645	10.90	26.20	5110	3790	96.3	95.2	93.0	86.9	99	98	90	65
30	80	1075	1675	13.10	31.40	6130	4550	96.5	95.4	93.3	87.3	99	98	90	65

ciency at lower operating cost and simultaneously increases normal life of lighting equipment. It should include:

1. Clean glassware on regular cleaning schedule. Dirty glassware will reduce light output 40 to 60 percent.

2. Replace lamps on regular schedule. If lamps are allowed to remain in service until they fail, the light output may drop 50 percent of its initial rating.

3. Paint all exposed metal surfaces properly. This applies particularly to poles, brackets and luminaires.

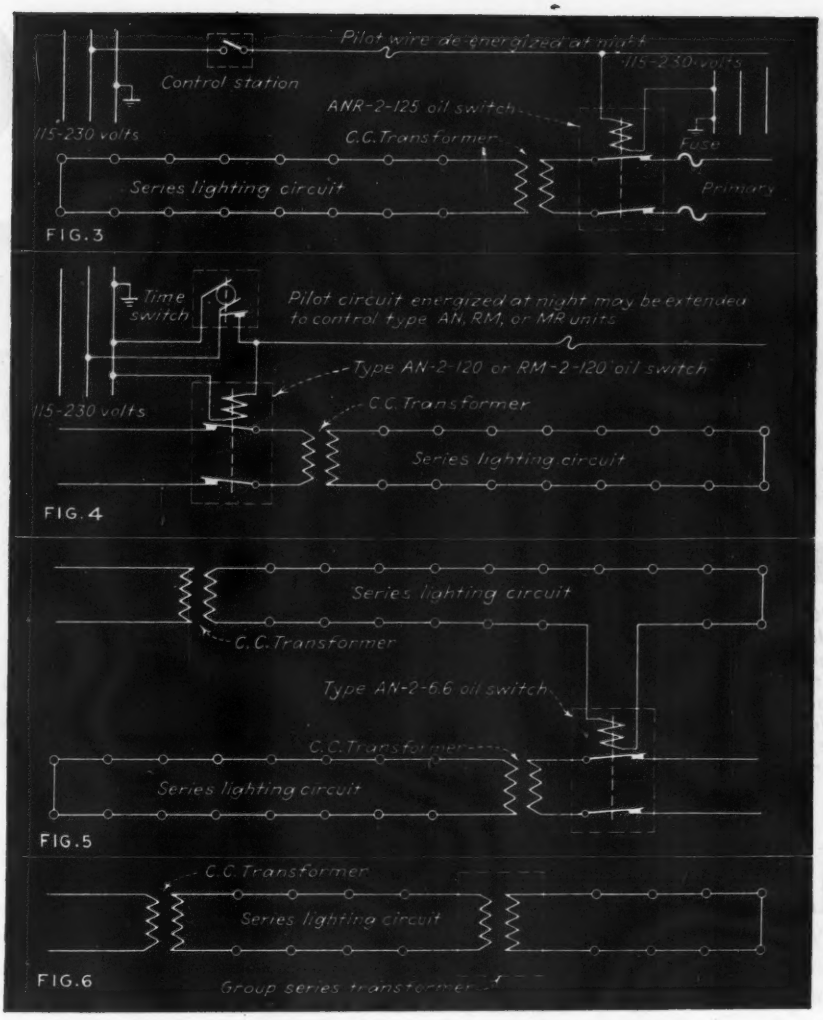
4. Check electrical parts of luminaires periodically. Loose connections cause heating and burning of the current-carrying parts. In time, loose socket connections may cause complete failure of the socket and receptacle.

5. Replace immediately such parts as: hard or broken gaskets, burned sockets, worn or bad lead wire and cracked globes.

6. Constant current regulators require very little attention. An occasional check to see that the oil level is proper and that the regulator is not overloaded is advisable.

7. A check of secondary current should be made from time to time to see if proper current is being delivered to the lamps. A slight overcurrent will shorten their life. For example 1 percent overcurrent may reduce lamp life by 20 to 25 percent and 2 percent overcurrent may result in 35 to 40 percent reduction in life.

8. Underground cable should be tested for resistance to ground, and any weak points repaired before actual failure occurs. If complete breakdown happens an entire section of cable may be ruined.



9. Good maintenance will correct trouble before it develops. It is good insurance against costly breakdowns. Trouble shooting suggestions appear in Chart A. The best way to avoid trouble is to correct it before it occurs.

Above

FIGS. 3, 4, 5, and 6. Types of series lighting circuits (see text) and control methods.

Table C

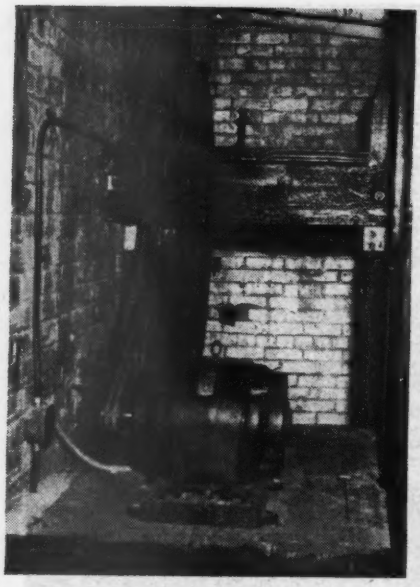
LAMP CAPACITIES OF POLE OR SUBWAY-TYPE REGULATORS

(6.6 or 20 Ampere-60 Cycle Only)

NUMBER OF LAMPS

	Straight Series with Film Cutout								With Isolating Current Transformer							With Auto-Transformer				
	6.6 Ampere				20 Ampere				6.6 Amp.		15A.	20 Ampere				15A.	20 Ampere			
Rating KW	1000 Lumen	2500 Lumen	4000 Lumen	6000 Lumen	6000 Lumen	10000 Lumen	15000 Lumen	25000 Lumen	1000 Lumen	2500 Lumen	4000 Lumen	6000 Lumen	10000 Lumen	15000 Lumen	25000 Lumen	4000 Lumen	6000 Lumen	10000 Lumen	15000 Lumen	25000 Lumen
2	28	12	8	5	6	3	2	1	24	10	7	5	3	2	1	7	5	3	2	1
3	43	18	12	8	9	5	3	2	32	15	10	7	4	3	2	11	7	4	3	2
5	72	30	20	13	13	9	6	3	53	25	17	12	7	5	3	18	13	8	5	3
7.5	108	45	30	20	20	12	9	5	80	38	26	18	11	7	5	27	19	12	8	5
10	144	60	40	26	28	16	11	7	107	51	35	25	15	10	6	37	26	16	11	6
15	216	90	60	40	41	25	16	10	160	76	52	37	23	15	10	55	39	24	16	10
20	288	120	80	55	55	34	22	13	215	102	70	50	30	20	12	74	52	32	22	12
25	360	150	100	66	69	42	28	17	268	127	87	62	38	25	16	92	65	40	27	16
30	432	180	120	80	83	50	34	21	322	152	104	74	46	30	20	110	78	48	32	20

MOTORIZING H



***POWER UNIT** for the rehabilitated elevator consists of a 3 hp., 1150 rpm., 3-phase, 220-volt motor which drives the old rope wheel through a jack-shaft and V-belt arrangement. Note the brake release solenoid (top, left) which releases the mechanical brake through a lever-arm attachment.*



How a San Antonio motor shop solved the materials handling manpower problem in small food processing plants by supplanting old elevator hand ropes with V-belt electric motor drives.

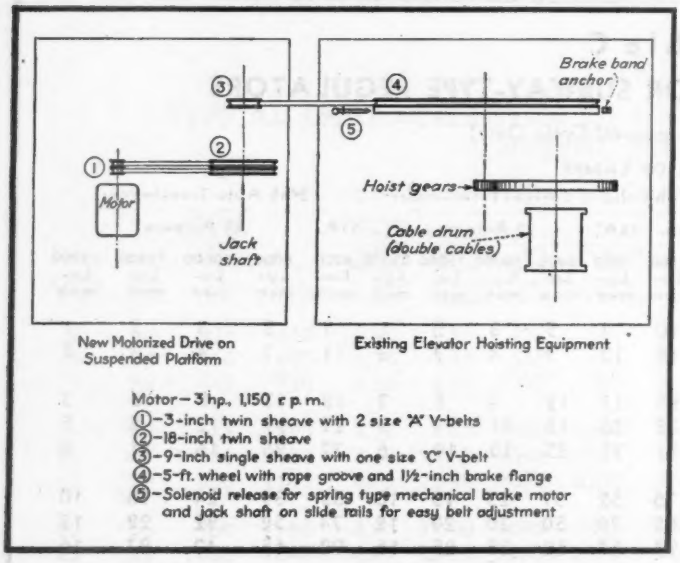
***A. C. LOYD** whose hobby of "designing things" and electrifying hand drives pulled many San Antonio industrials out of a tough spot when the manpower shortage became acute.*

LOSS of unskilled manpower to the armed services left the small food processing plants in San Antonio, Texas, in somewhat of a spot. With production demands at a peak and no one to tug at the ropes of their hand operated elevators, their materials handling problem became acute. Elevator companies, who could offer no help because of difficulty in obtaining equipment and the backlog of government orders, suggested the plants contact the Loyd Electric Co., enterprising electrical contracting and motor service organization in San Antonio.

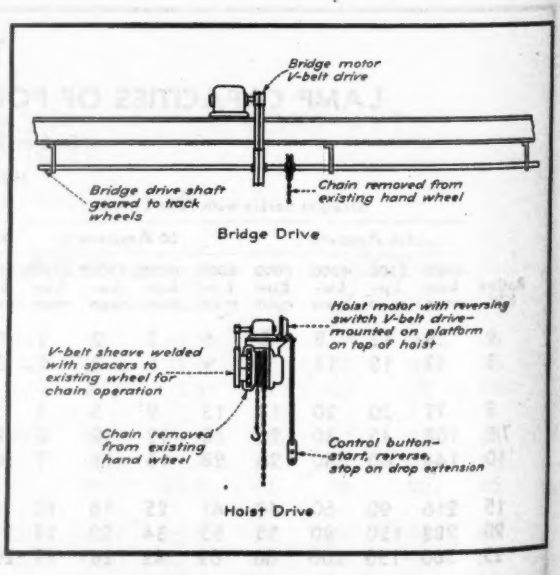
They followed this advice and secured the relief they were seeking. Now, thanks to the engineering astuteness of A. C. Loyd, professional engineer and partner in the company, some 30 food processing plants are moving more material than ever before with less manpower. And what's more, they are saving from one to eight dollars per day in materials handling costs—depending upon how frequently their elevators are in use, the load per trip, and the number of men formerly needed to operate the old rope drive.

Loyd's answer to the problem was —"utilize the existing elevator equipment but discard the old hand rope and install an electric motor V-belt drive. Let electric power do what the brawn and sweat of man formerly did."

A typical example of a Loyd "elevator motorization project" is that in the plant of the Texas Vegetable Oil Company at San Antonio, where he



***PLAN VIEW** of pulley arrangement for new motorized drive showing the combination of new and existing equipment that now comprises the elevator mechanism.*

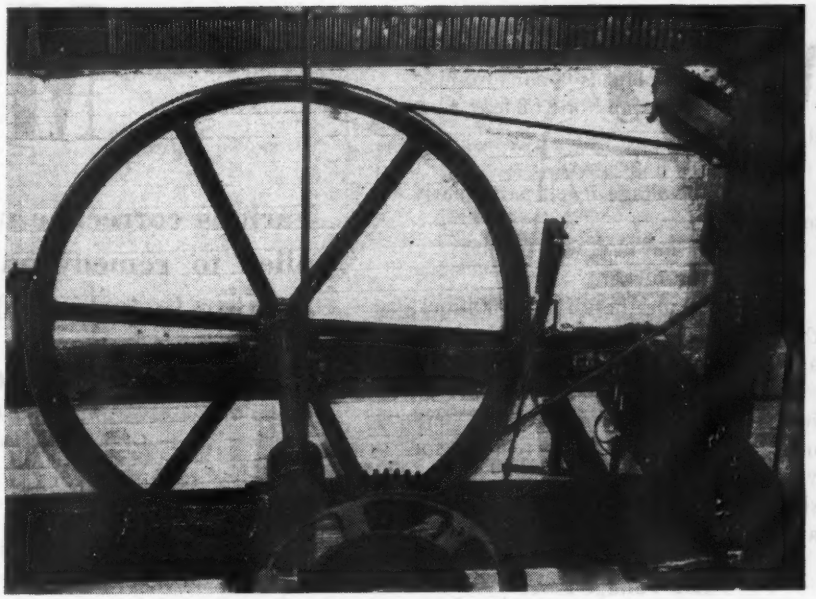


***DIAGRAMMATIC SKETCH** showing how the Loyd Electric Company motorized a hand operated bridge crane and hoist with V-belt.*

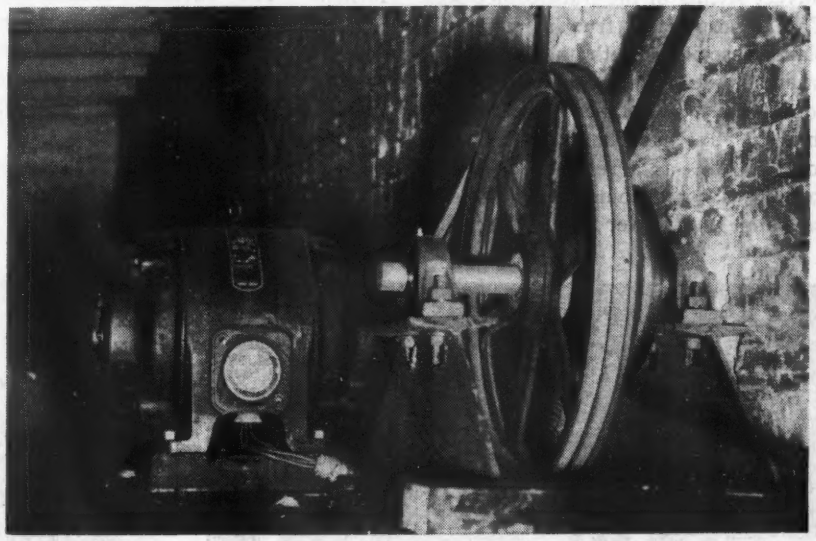
HAND ELEVATORS

effected an $8 per day saving in handling materials. Here a 3 hp., 1150 rpm., 3-phase, 220-volt, motor is mounted on a ceiling suspended platform and V-belt connected through a jack-shaft to the 5-ft. diameter rope drive wheel on the existing elevator hoisting mechanism (see attendant diagram). Two size "A" Gates V-belts on a 3-inch motor sheave drives an 18-inch twin sheave on the jack-shaft. Coupled to the jack-shaft is a 9-inch single sheave equipped with one size "C" V-belt which drives the 5-ft. diameter elevator wheel—the V-belt nesting in the old hand rope groove.

Finger-tip control is provided by start and reverse "hold-in" type push-buttons—one on the elevator cage and one at each service level such as basement, first and second floors. This type of control provides added safety since a release of finger pressure breaks the circuit, kicks out the reversing magnetic switch at the motor and stops the elevator. Limit switches at the lower and upper levels control the travel of the cage at these points.



V-BELT TAKES OVER, replacing the old hand rope that formerly turned this 5-ft. elevator drive wheel. V-belt nestles in old rope groove. Note spring attachment to wheel brake and lever arm to solenoid release.



JACK-SHAFT required to obtain the proper rpm. of the rope wheel is mounted on I-beam supports on the motor platform. Shaft coptains an 18-inch twin-groove sheave connected to a 3-inch motor sheave and a 9-inch single groove sheave which drives the old rope wheel.

Braking

The braking mechanism consists of a mechanical brake with a solenoid release. A 1½-in. by ⅜-in. metal brake band lined with truck type asbestos brake lining encircles the upper half of the brake flange on the old rope wheel. Permanently anchored at one side, this band terminates on the other side with double springs which provide the braking tension. Each spring is capable of braking the elevator itself—the double units being a precaution against one spring becoming weak. The solenoid, connected across the two protected legs of the motor circuit, releases the brake when the motor starts. If, for any reason, the current fails the solenoid drops out and the springs set the brake. Inability to obtain solenoids did not stymie the Loyd organization. They utilized the solenoid from an old 50-hp. automatic compensator and fashioned the fulcrum of the operating lever arm from an old ceiling fan hanger.

When changing over elevator drives of this type, Mr. Loyd keeps a sharp eye for safety features—making certain that the gears, cylindrical drum with its dual hoist cables, and counterweight cables are in A-1 condition. Safety gates must be in working order before he leaves the job.

There is a considerable amount of engineering involved in a changeover of this type. It's not simply a question of hooking a motor and some V-belts to the hoist mechanism. Factors that must be considered in the calculations include (1) the distance the load must be lifted, (2) the maximum load per trip, (3) the weight of the cages—in most cases balanced by counterweights, and (4) the speed with which the cages should be lifted.

By counting the rpm. of the rope wheel (as men operate the elevator at their maximum speed, and then adding a little; and by knowing the speed of the motor to be installed, the diameters

[Continued on page 172]

Voltage Improvement Methods

Various corrective measures can be easily applied to remedy any poor voltage condition existing in industrial plants.

By W. C. Bloomquist
Industrial Engineering Division
General Electric Company, Schenectady

WHEN we say the voltage in an industrial plant is "poor" we may be implying any one of four conditions:

1. A low-voltage level.
2. A high-voltage level, particularly at light load.
3. A variation in power supply.
4. Lighting flicker.

In considering these four conditions, this article will discuss only the voltage improvement of a single feeder circuit rather than that of the overall industrial plant system. Table I summarizes the causes and corrections for various voltage conditions. Fig. 1 shows schematic diagrams of corrective arrangements.

Low-Voltage Level

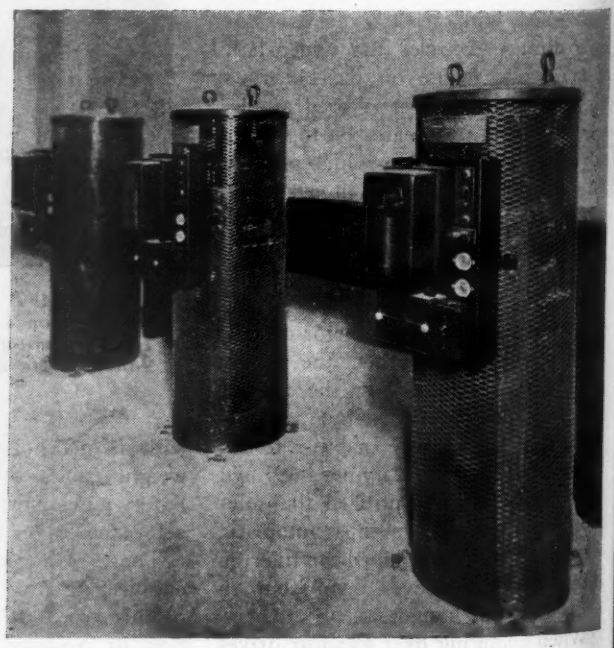
What is the cause of low voltage? One of the most common causes is incorrect setting of the transformer taps. This is especially true in industrial plants associated with the war effort where the electrical load has increased considerably. An increased drop of three to five percent through transformer banks as a result of increased loading is not uncommon. The usual tap range on a power transformer is 10 percent in either four 2½ percent or two 5 percent steps, and it may be possible to increase the voltage level by changing to a *lower* high-voltage tap setting.

The voltage level may also be raised by a voltage regulator or autotransformer. The autotransformer costs less but the regulator is preferred because of the operating benefits associated with a variable regulating device, particularly when such a device can be controlled automatically.

Another cause of low voltage is excessive feeder voltage drop, which is usually due to the high impedance of the circuit rather than to the magnitude of the load or to poor power factor. When the circuit resistance, reactance, load, and load power factor are known, it is easy to predict the voltage change caused by a change in the circuit or load. However, it isn't necessary to know actual values to make general predictions. For example, if we have a load with a low power factor carried over a circuit consisting of a three-conductor cable of small wire size (high resistance and low reactance), we can immediately predict that improving the load power factor will re-



SPOT WELDER rated 190 kva. is equipped with thyratron phase control, sequence control, and series capacitor for power-factor improvement.



AIR-COOLED automatic voltage regulators, 12 kva., 120 volts, in lighting circuits in plant of the Hanes Hosiery Mills Co., in Winston-Salem, N. C.

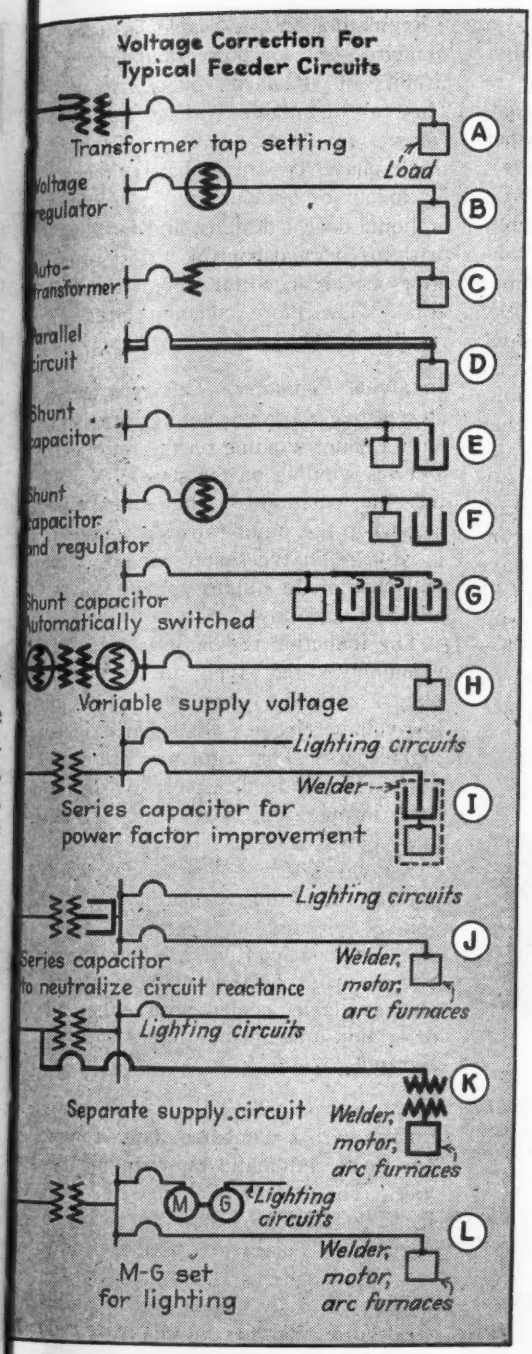


Fig. 1

HOW TO IMPROVE VOLTAGE CONDITIONS

LOW VOLTAGE

Feeder Voltage Condition	Circuit Loading	Power Factor	Correct by means of	See Fig. 1
1. Low	Normal	Good	Transformer tap setting	(A)
			Voltage regulator	(B)
			Autotransformer	(C)
2. High feeder drop.	Normal	Good	Voltage regulator	(B)
			Parallel circuit	(D)
			Autotransformer	(C)
3. High feeder drop.	Normal	Low	Shunt capacitors	(E)
			Voltage regulator	(B)
4. High feeder drop.	Overload	Low	Shunt capacitors	(E)
			Shunt capacitor and voltage regulator	(F)

HIGH VOLTAGE

1. Normal drop.	Normal	.....	Voltage regulator	(B)
			Transformer tap setting	(A)
2. Normal drop.	No load	.....	Voltage regulator	(B)
			Transformer tap setting	(A)
3. Voltage rise	"No load" (Except shunt capacitors are on)	Leading at no load	Automatic switching of capacitors	(G)
			Voltage regulator (if no penalty clause for leading power factor)	(F)

VARIABLE SUPPLY VOLTAGE

(Voltage regulator is only practical solution) (H)

LIGHTING FLICKER

Load Causing Flicker	Correct by means of	See Fig. 1
1. Resistance welders spot or seam.	Series capacitor with welder to reduce demand by power-factor correction	(I)
	Series capacitor in line to neutralize system reactance	(J)
	Separate welder supply circuit	(K)
	MG Set for lighting circuit	(L)
2. Flash, resistance welders.	Separate welder supply circuit	(K)
	MG Set for lighting circuit	(L)
3. Motor loads, such as: Sawmills, Rubber mills, Grinders.	Series capacitor in line to neutralize system reactance	(J)
	Separate motor supply circuit	(K)
	MG Set for lighting circuit	(L)
4. Arc furnaces.	Same as for (motors)	

Table I

sult in only a small reduction in the voltage drop. If, however, the circuit consists of heavy conductors (low resistance) spaced far apart (high reactance), we would expect that improving the load power factor would result in a substantial reduction in voltage drop. Why? Because the voltage drop in an a.c. circuit is made up of the drop in the circuit resistance and the reactance. This latter drop is caused by the reactive current which is determined by the power factor of the load. The higher the power factor, the lower the reactive drop and, where the circuit reactance is high compared with the resistance, the reactive voltage drop decreases faster than the line current, so the net result is a decrease in voltage drop.

The voltage drop in feeder circuits of plants using the load-center principle of distribution is small—only a few percent—because of the short feeder runs, small blocks of power per circuit, and the use of three-conductor cables. In contrast, the feeder drop is apt to be high in plants employing the old method of distribution where large blocks of power are transmitted long distances at low voltage via bus run systems in which for mechanical or structural reasons, the bars, tubes, or conductors are spaced far apart.

When the feeder voltage drop is high and is due to the high reactance of the circuit and the low power factor of the load, shunt capacitors may be used to improve the voltage level as well as to improve the power factor. Take, for example, the case of a 400-ft. three-phase circuit of 500-MCM conductors spaced on 10-inch centers and a load of 800 amps. at 70 percent power factor. Under these conditions, the voltage drop is approximately 42 volts. If shunt capacitors are applied to improve the power factor from 70 to 95 percent, the voltage drop is approximately 20 volts, making an improvement of 22 volts. Although the volt-

age level is improved with shunt capacitors the difference in the feeder voltage between the full-load and no-load conditions is approximately the same as it was before the shunt capacitors were added, the result may be that the voltage at no-load will be too high.

The use of shunt capacitors for power factor improvement also offers other benefits, such as: reduced feeder losses; release of system capacity; and, in many cases a substantial saving in the power bill.

The voltage drop in a feeder circuit can be decreased by adding new circuits in parallel, but generally this is not economical.

High-Voltage Level

A high-voltage level under normal load conditions is generally caused by the high-voltage of the incoming supply and must be corrected by reducing this voltage either by adjusting transformer taps or by using a voltage regulator or a step-down autotransformer.

If the high-voltage is at no-load and is associated with a circuit having a large block of shunt capacitors, it will help to switch the capacitors automatically in several blocks or steps. For example, a suitable control can be used to remove automatically one block of capacitors at a time as the load decreases or as the voltage increases. Therefore, at light-load conditions only a portion of the capacitors may be "on" and the voltage rise will be small.

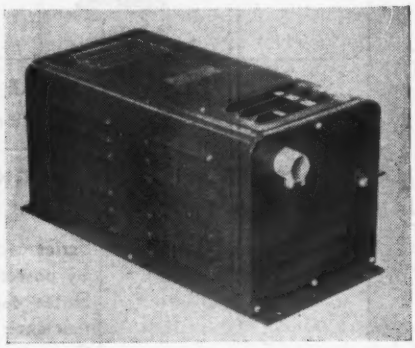
By voltage variation is meant the normal change in system voltage during the day due to variations in the incoming supply or changes in the voltage of the plant feeder circuit caused by load changes. In both cases, the only solution is an automatic voltage regulator.

A typical installation of an automatic voltage regulator for a single-phase lighting circuit is here shown. This regulator furnishes constant voltage to the lights regardless of variations in the voltage feeding this circuit.

Where it is desired to obtain constant voltage from a variable source and extreme accuracy and speed of response are important, another form of regulator—often called a voltage stabilizer—is used. This regulator has no moving parts, so is inherently fast in operation.

Flicker problems are associated with intermittent, fluctuating, or suddenly applied loads, such as seam or spot welders or fluctuating motor loads of rubber mills, sawmills, or heavy grinders. In all of these cases, it is not only the magnitude of voltage dips but also their frequency that determines whether or not the flicker is objectionable to workers. Extensive tests show that, with a frequency of 2 to 10 cycles per second (common for seam welders), voltage variations as low as half a volt (115-volt reference) are objectionable.

It is difficult to maintain a low voltage drop on welder circuits without some corrective means because the maximum kva. demand of the welder is high—up to five times its normal rating—and the power factor is low. Voltage improvement is obtained either by reducing the kva. demand or by reducing the circuit impedance—both methods using series capacitor equipment. Series capacitors used in conjunction with individual welders have the added advantage of reducing the kva. demand, which might be a factor in reducing the power bill. When there are many welders on a single circuit, a line-connected series capacitor is economically desirable. A typical series capacitor equipment for use with resistance welders is shown.



***VOLTAGE STABILIZER** rated 500 kva. provides practically instantaneous voltage correction and is without moving parts.*

In motor applications, a series capacitor connected in the line is used to reduce the voltage drop by neutralizing the circuit reactance. In order to be effective, a line-connected series capacitor must be connected ahead of the point of flicker as shown in Fig. 1-J.

Another solution for flicker problems is a separate transformer supply circuit for the flicker-producing load and connected ahead of the lighting load. Also, in some cases, a motor-generator set is used for the lighting load alone.

Voltage Regulator Equipments

Since the voltage regulator has such a wide field of application, a brief description of the most common types applicable to industrial plants is included.

Regulators are available in many standard sizes for power and lighting circuits of standard voltage ratings. They are available with a standard voltage range of ±10 percent for single-phase or three-phase circuits, for indoor or outdoor use, in dry-type or liquid-cooled designs, and for automatic or manual control. Most regulators are arranged for automatic operation. The more common types of regulators are:

Induction Regulator—This type operates as a variable autotransformer, with a shunt winding on the rotor and a series winding on the stator. Varying the position of the rotor with respect to the stator causes a variation of voltage in the series winding that will change the output voltage gradually and smoothly.

The induction regulator is the most commonly used type in industrial plants, with the majority applied on low-voltage circuits, particularly lighting feeders. The regulators are compact, self-contained, usually air-cooled, quiet in operation, neat in appearance, and easily installed.

Several different types of air-cooled dry-type induction regulators for low-voltage circuits are shown. Larger sizes and ratings for use on power circuits from 2,400 to 4,800 volts are also available, cooled with either oil or a non-inflammable liquid such as Pyranol.

Step Regulators—This is a transformer with a number of taps brought out to an automatic tap-changing device. The voltage is changed in small incremental steps, hence the name step regulator. This type is used for power circuits, such as main transformer banks or heavily loaded feeders, and is especially suited for circuits from 2,400 to 69,000 volts such as encountered on an incoming line circuit.

Voltage Stabilizer—The voltage stabilizer is a special form of regulator without moving parts; its operation is dependent upon static devices—a reactor and capacitor combination. The voltage stabilizer provides practically instantaneous correction of a voltage condition due either to a varying imput voltage or a variation in the magnitude of the load. It is limited to voltages up to 600 volts and to sizes up to 5 kva., single phase.

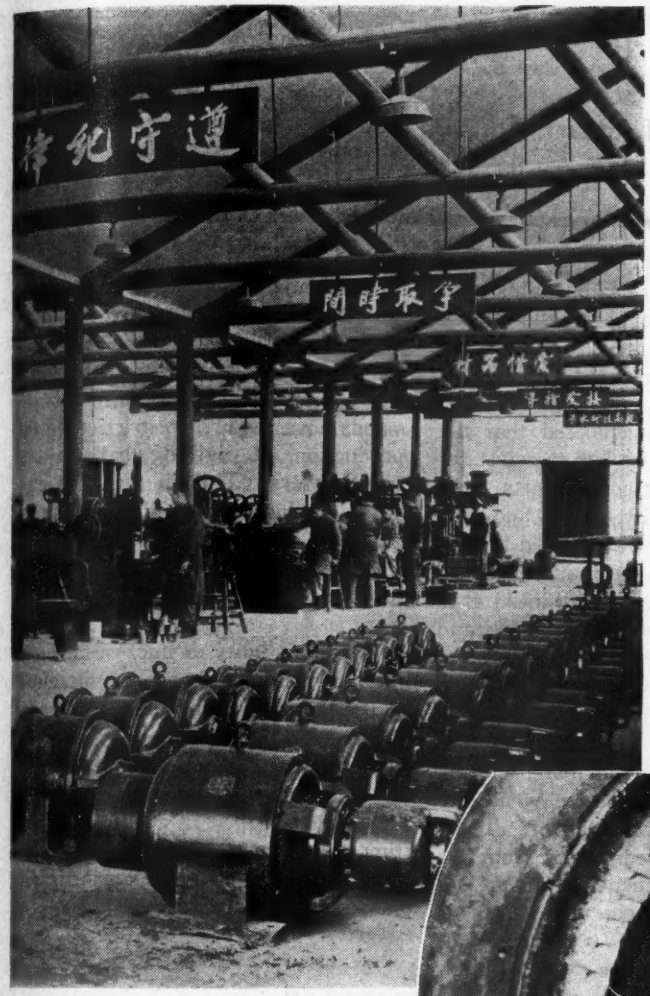
Conclusion

An automatic voltage regulator is usually the most satisfactory means of

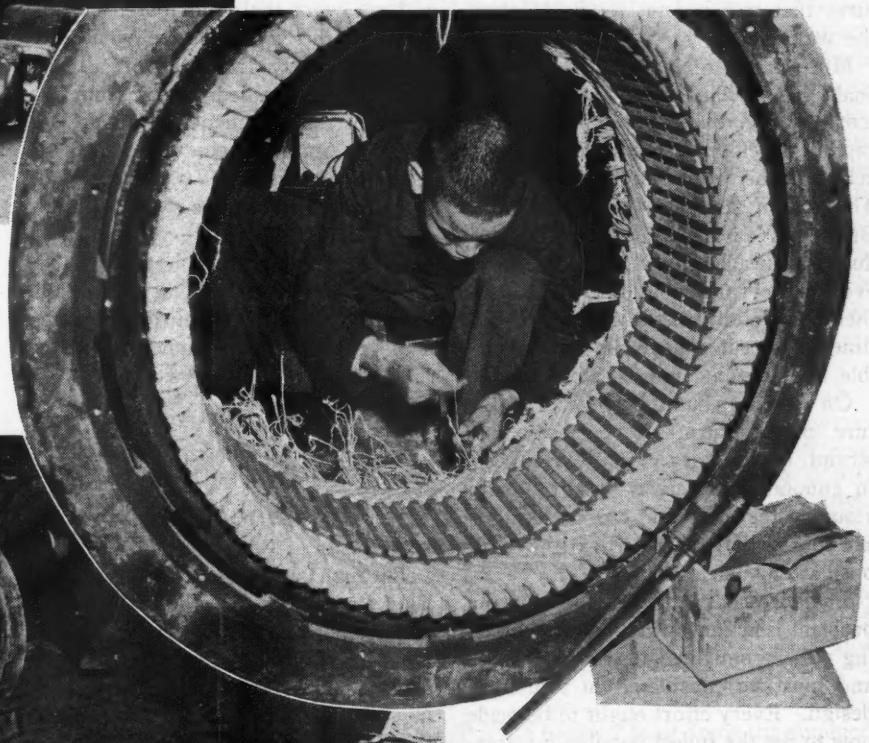
[Continued on page 164]

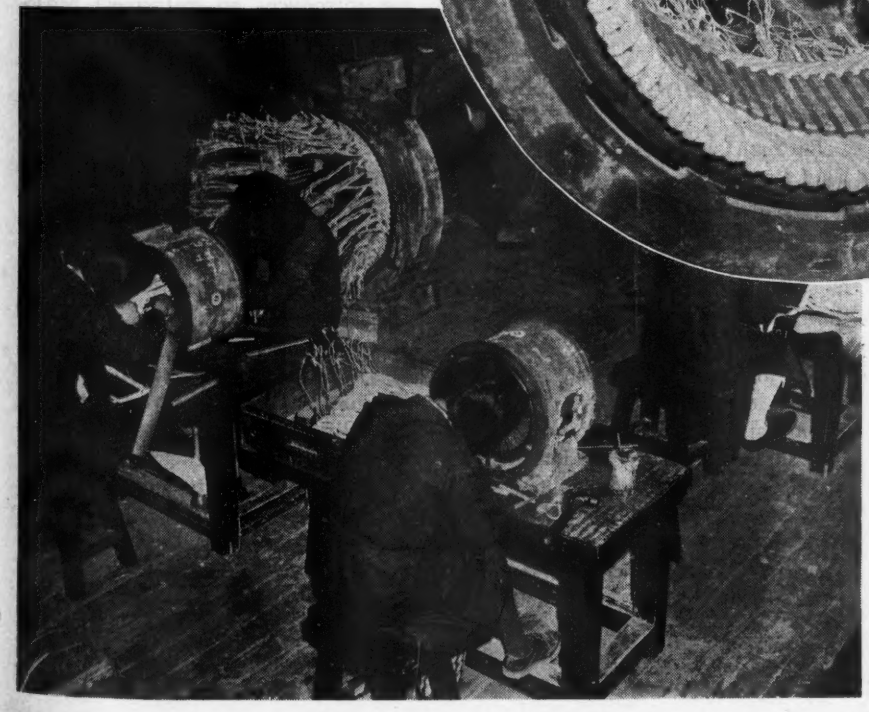
Windings In CHINESE

Behind the battle lines in war-torn China a courageous people carry on. Their electrical industry, geared to war needs, works with apparatus and materials identical to our own. These photos, from the Chinese News Service, are a glimpse of how modern China handles motor winding jobs.



GENERATOR SHOPS of the battery factory of the Central Electric Works near Kweilin. The signs are shop slogans. They say "Obey discipline", "Waste no time", "Save equipment and material", "Follow Instructions", "Raise the technical standard."





***CONNECTING THE** stator winding of a 250 kva. generator. Hand work of Chinese craftsmen shows characteristic native precision.*

***WOMEN WORKERS** tape coils, install slot insulation and lay in the stator coils.*

EDITORIALS

W. T. Stuart, *Editor*

Postwar Design Information Needed Now

A study of building plans now on the shelf for postwar construction shows evidence of considerable progress in almost every branch of construction. The war years have been fruitful of new materials and methods that will be immediately adaptable to building when war limitations are removed.

In lighting, however, there seems to be a dearth of courageous design. Lighting plans have been left open, waiting, we are told, for more information about the types of lamps and fixtures that will become available after the war.

Much of the reluctance to nail down final lighting plans is due to some of the more imaginative forecasting that is rapidly developing into a severe headache for the whole building industry. The dream stuff has been overdone. But we have been so accustomed to industrial miracles during the war that even conservative building men with their feet solidly on the ground are inclined to accept some of the more plausible imagineering uncritically.

On the other hand, however, the fixture manufacturers have shown restraint, unnecessary in many instances, in announcing postwar designs or in assuring the trade that current designs are substantially those which they will push after V day.

In fluorescent lighting especially the problem is acute. Much postwar lighting will be built in. It will take space and must be considered in structural design. Every effort ought to be made now to get the fullest possible information out to the trade.

Veteran Reinstatement

The rules and laws pertaining to reinstating returning veterans in their old jobs should be carefully studied by all business men. The time is not far off when substantial numbers of men will be released from the armed forces. They will have certain rights and privileges that should be thoroughly understood if they are going to be absorbed smoothly into the economy of the community.

It should be remembered that the veteran is entitled by law to reinstatement in his former position or a position of like seniority, status and pay. However, he must be qualified to perform the duties of the position and he must make application within 40 days after he is relieved from service and the employer's circumstances have not so changed as to make it impossible or unreasonable to reinstate the veteran.

A great many returning veterans will not want their old jobs back and many of the younger men went into service directly from school. These men will be entitled to aid from the Veteran Employment Division of USES. And, of those men who have received specialized training, some will want to follow their special abilities in civilian life.

It is the nation's job to give the veteran every help and consideration. The whole operation can be expedited if there is a thorough knowledge of the rules throughout business.

Ballasts Are The Bottleneck

Through close cooperation with the War Production Board and ingenious design changes, lighting fixture manufacturers have kept war production needs supplied with high quality lighting fixtures under very severe material limitation. Much credit is due the industry for the way they have maintained high quality standards through this era of metal scarcity.

Limitations on the use of metal in lighting fixtures are gradually being lifted as supplies become more abundant and it won't be long before restrictions can be lifted entirely. But even as the way is cleared for more metal, the prospects for fluorescent lighting ballasts become more critical.

The ballasts used for hot cathode fluorescent lamps and the transformer for cold cathode lamps are made by the same manufacturer and use the same production facilities as radio and radar coils and other transformers for combat equipment. Heavy military demands have required restriction on the production of lighting ballasts and transformers. This in turn has curtailed production of lighting fixtures. A WPB inventory of ballasts and transformers in the hands of manufacturers and wholesalers is now under way.

The availability of fluorescent lighting fixtures is closely geared, therefore, to the military scene. Radio and radar demands will continue as long as the war. It is all the more important therefore that urgent postwar lighting jobs be planned now. It will take a long time before the supply of lighting fixtures will begin to approximate the postwar demand.

Versatile Cathode Ray

Electronic apparatus in industrial use today and its inevitable extension postwar into other phases of daily living introduces an instrument heretofore secluded in the laboratory—the cathode ray oscilloscope. In spite of its impressive name and the array of circuits, tubes and appurtenances with which it is usually equipped, it is fundamentally a simple instrument. And every man concerned with electrical apparatus should become familiar with its structure and its use.

A stream of electrons focussed to a point on a fluorescent target is moved across the target by impressing a voltage on a set of plates, one set deflects horizontally, the other vertically. Essentially it is a voltmeter in which the indicating hand has neither weight nor inertia and is free to move in two directions. Consequently, with appropriately calibrated scales it can be made to indicate voltage, current, power factor, synchronism or any electrical phenomena that can be rendered as a voltage or voltage comparison.

In contrast to indicating instruments,

however, the cathode ray can respond at very high speeds. Transient phenomena can be "stopped" for critical analysis. Thus in testing electronic apparatus, where timing of extremely short duration is frequently used, the cathode ray is a versatile and, in fact, an essential instrument.

The use of the cathode ray oscilloscope for trouble shooting, testing and maintenance of conventional electrical apparatus is relatively rare. Wider use of the instrument with industrial electronic apparatus will point the way, however, to many uses on other electrical circuits. And the use of the oscilloscope may eventually become an important part of the know-how of the industry.

Paradoxes At High Frequencies

Is good solid copper carefully grounded often used as an insulating support? Can a piece of rubber or plastic be heated by running an electric current through it? Can a grounded and empty metal tube be used to pipe electric currents?

Anyone who has ever wired a doorbell would find these questions so obviously opposed to the most elementary principles of insulation and conduction as to appear ridiculous. Actually, however, they are all true. They are, in fact, practical and useful methods used with high frequencies.

When alternating currents are produced at many millions of cycles per second, high impedance is encountered in materials that at lower frequencies are considered excellent conductors. The characteristics of insulations change too. And the engineer uses these and other qualities of high frequency in putting it to use.

The first question refers to a method of supporting a high frequency line. A resonant loop introduces a standing wave. The loop is fastened to its support at the null or point of zero voltage. The second question refers to the new technique of dielectric heating in which high frequency currents flow between energized plates. The third question refers to the wave guide used to conduct ultra high frequency energy. A rectangular tube literally pipes the current flow.

The rapid development of new techniques at the higher frequencies will inevitably crowd out a lot of our conventional concepts of electrical phenomena. More important, they promise to find their way into everyday uses. More and more keeping up with this advancing industry demands continuous education and active interest in fields that were unknown frontiers only a few years ago.

Fire Prevention Is A Personal Job

The week of October 8–14 will be observed as National Fire Prevention Week. How important it is that we regularly emphasize the hazards of fire on a national scale is plainly evident from the statistics.

In 1943, a loss of $25,000 or more was involved in each of 105 fires. The largest single loss was over $3,000,000 in a New Haven fur storage warehouse on September 24, 1943 and is believed to have started because an unprotected drop light came in contact with combustible material.

Those 105 fires cost a total of 103 lines and it is important to note that the average number of building fires rose 11.3 percent in 1943 and the per capita loss increased 30 percent.

On July 6, 1944 a circus tent burned taking 164 lives. That tragedy, appalling even in the midst of war, with its rows of charred little bodies waiting for heartbroken families, will be a statistic contributing to the 1944 total losses. Of course, such statistics are a useful means of getting at fire losses objectively, unemotionally and impersonally. But too often they are a convenient escape for us as individuals from thinking of fire prevention as a personal matter.

Fires of electrical origin still contribute a very large segment to the annual fire loss charts. We have built up a body of rules and technical skills which can give the public sure protection. Most electrical fires are a result of failure to observe those rules, unskillful or careless use of electric wiring and apparatus and plain ignorance. If we do nothing more than individually and continually foster respect for fire prevention rules and intelligent use of electrical equipment, those losses can be cut enormously.

Washington Notes

▶ With the good news of military victories pouring in daily, Washington is again seething with prediction of early collapse in Germany and a quick job on Japan. Enthusiasm is restrained, however, by some of the realities of manpower scarcity and a serious lag in the production of much needed equipment, large guns and ammunition, trucks, big tires and forgings are among the critical shortages that offset apparent generous surpluses in other categories.

▶ According to a statement by Chairman McNutt of WMC, it has become increasingly difficult to recruit workers for vital war jobs, primarily because of the not unnatural desire of the worker to find employment in activities that give promise of some postwar security. Yet in late July there was a net shortage of 200,000 workers in industries and services whose products and work are absolutely essential to the continued supply of our armed forces. And these shortages are in such vital industries as construction projects, ship repair and foundries.

▶ Construction activity during the first half of the year showed the first break in a long monthly series of decreases since August, 1942. A slight upturn of three percent which began in April was due to mild seasonal increases in private construction as public construction continued to drop. WPB predicts that the trend will turn downward again before the end of the year. WPB reports the estimated total construction exclusive of maintenance and repair will amount to $3,550,000,000, of which $2,171,000,000 is public and $1,379,000,000 is private.

▶ A new regulation that should help the critical shortage of fractional horsepower motors for replacement and farm use has finally been issued by WPB. Now all motors obtained with WPB-547 ratings can be sold only for replacement or for use by farmers. Trouble was that anyone with a high priority could lift small motors allotted to civilian use, now they are specifically earmarked for replacement use.

▶ War housing built since the summer of 1940 now total over 1¾ million units. Practically all of the publicly financed housing now being built will be torn down after the war. Urgent war housing needs have now been met with the exception of a few critical areas, particularly on the Pacific Coast.

▶ The integral horsepower electric motor industry advisory committee has recommended that no new motors be sent to foreign countries if satisfactory surplus motors are available.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

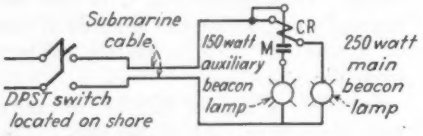
PROTECTION AGAINST BEACON FAILURE

CONTROL

Beacon lights, used as a guide for boats in waterways and harbor installations have the unhappy faculty of burning out at the most inopportune time, namely during a storm or heavy fog. Beacon failure not only endangers ships and personnel, but also the life of the electrician whose duty it is to take a rowboat out to "Aunt Phoebe" (the beacon light) and replace the burned-out bulb.

A few stormy trips mothered a suggestion by the chief electrician at a Coastal Army Post which would keep old Phoebe burning until such time when bulb replacement would be less hazardous.

A three-wire submarine cable was used to supply "Aunt Phoebe" with two separate circuits—one for the beacon light and one for the foghorn. A new submarine cable could have been laid for an auxiliary light but that would have been expensive from the standpoint of cost, time and material.



***CIRCUIT DIAGRAM** of main and auxiliary beacon spotlights controlled by a series relay to assure continuity of the guiding light.*

The suggestion entailed the installation of a series relay coil in the main 250-watt beacon spotlight circuit with a normally-open contact as in the accompanying diagram. The relay holding coil was wound in the Post electrical shop with No. 22 enamelled magnet wire to give about a five volt drop. The beacon light circuit, which is controlled from a double-pole, single-throw switch on shore, normally operates with the main 250 watt spotlight "on", the relay energized "open", and the 150 watt auxiliary beacon spotlight "off". If the main beacon burns out opening the relay circuit, the relay becomes de-energized, the relay contact closes and the auxiliary beacon comes on automatically. Thus Aunt Phoebe continues to light the way for the boats coming up the waterway through fair weather or foul, and the electrician can await the calm before venturing out in his frail craft.

The suggestion of connecting an auxiliary beacon through a series relay came from Sydney Stargatt, present chief electrician at the Post where the installation was made. Stargatt, who was formerly a New York City electrical contractor was awarded an engraved certificate and $25.00 by the Commanding Officer, Colonel Bernard Lentz, and was the first civilian to win an award at this particular Army Post.



***THE COPPER SHOP**, which handled all the copper bus work in wiring the Aluminum Company New York City plant, was provided with two buzz saws for cutting copper bus and copper channel. One was purchased and since a second was unobtainable, the construction engineers hurriedly designed and built one from angle iron and a spare motor. Here it is being used to whack off a section of heavy bus. It may look a little crude, but it does equally as good a job as the purchased one.*

MECHANICAL CONSIDERATIONS IN THE CARE OE RESISTANCE WELDERS

MAINTENANCE

By E. R. SPITTLER*

Uninterrupted production, as well as consistent, high-quality resistance welding results, depend to a great degree on the proper maintenance of resistance welding equipment. The maintenance tips in this short, to-the-point article are the result of many years of practical experience with resistance welding equipment in G-E plants.

Obviously the object of this short

**Works Laboratory, General Electric Company.*

No. 1 in a series published by SYLVANIA for all users of fluorescent lighting

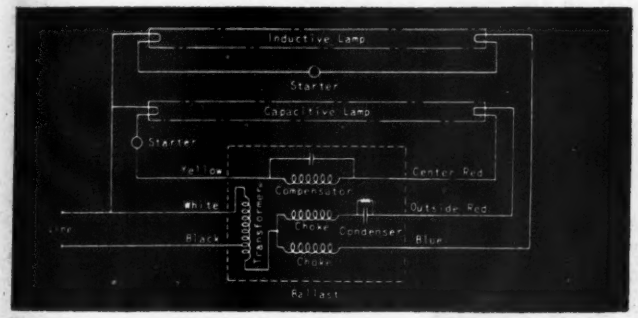


Fluorescent operating hints

BALLASTS

The ballast is a current-limiting device essential to the operation of fluorescent lamps. Without a ballast, the current would rise instantly to a value that would destroy the fluorescent lamp, which is an electrical arc-discharge source.

The ballast consists of an iron-core choke coil and condenser elements embedded in insulating compound. Only the wires necessary for connections with the external circuit are visible. The diagram below shows the internal elements of a ballast and the hook-up in a typical two-lamp circuit.



Ballasts also provide for power-factor correction. A high power factor is essential to lighting efficiency. The table below shows the wattage consumed by both the single and two-lamp types of ballasts.

BALLASTS FOR FLUORESCENT LAMPS

Lamp Size	Line Volts	Approximate Wattage Loss	
		Single Lamp Type	Two-Lamp* Type
6	110-125	2	—
8	110-125	2.8	—
15	110-125	4½	9
20	110-125	4½	9
30	110-125 199-216 220-250	10 9 9	14½ 12 12½
40	110-125 199-216 220-250	13 12 13	17½ 13½ 14½
65	110-125	12	24
100	110-125 199-216 220-250	24 24 24	35 35 35

*Wattage loss is for both lamps.

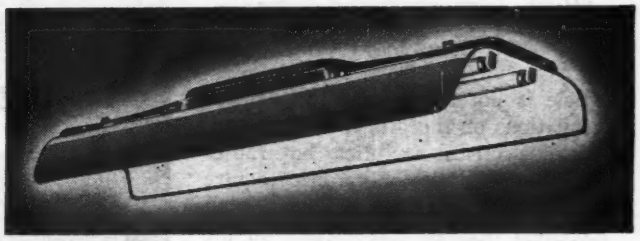
BALLAST SERVICING

Properly designed and installed ballasts last indefinitely under favorable conditions. That is why the ballast is the last thing to check when lamps fail to light. When you are sure that starter and lamp are not at fault, test the ballast by hooking up a bell ringer in series with the coils. If bell fails to ring, you know that ballast is defective.

Don't Try to Repair a Bad Ballast. Replace it with a new one. Then there will be no risk to your investment in fluorescent equipment.

A hum that grows in severity is a sure sign of impending ballast trouble.

Improper ballast equipment can cause lamps to blink with a definite "on" and "off" period and thereby shorten lamp life. Be sure to use the right ballast replacement, as specified by the manufacturer of your particular fixtures.



THE BALLASTS ARE RIGHT IN SYLVANIA "PACKAGES OF LIGHT"

Sylvania sells industrial and commercial fixtures complete with lamps, ballasts, sockets, starters — wired and ready for immediate installation. The ballasts in every Sylvania fixture are made to the same high quality standards as Sylvania lamps, starters, reflectors and sockets.



For Additional Maintenance Information
Send For This Free Booklet

SYLVANIA ELECTRIC PRODUCTS INC.

"Fluorescent at its Finest"

• SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES



FIG. 1. Welding transformer of spot-welding machine, being cleaned.

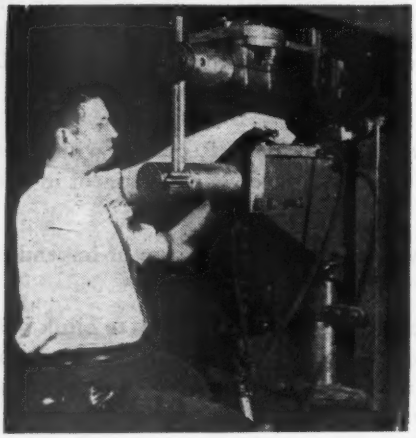


FIG. 2. Joints of secondary electric circuit being tightened on spot-welding machine.

article is not to give detailed recommendations on the proper maintenance of the electrical facilities, but rather to point out those units that require special attention in a mechanical sense. Excellent detailed information on the installation, inspection, maintenance, and trouble shooting of individual units can be obtained from manufacturers.

Transformer—If the welding transformer is water-cooled, be sure that free circulation of water takes place at all times during the operation of the machine. Remove all dirt, dust, and grit from the transformer and secondary circuit at least once a week (Fig. 1). An accumulation of flash particles will cause a short circuit in the transformer winding, thus reducing its efficiency, increasing operating costs, and eventually causing the transformer windings to burn out.

Switches, Contactors, Timing Devices—These are the nerve centers that control the operation of a welder and, consequently, must always be in good condition, mechanically and electrically, to assure efficient operation. They should be checked every two months for evidence of wear, such as oxidation at fuse connections in switches, loose electron tube sockets, and loose wiring in timing devices (Fig. 2).

Electrodes or Dies — Electrodes, welding wheels, dies, or mandrels that have become burned or pitted with steel are a constant source of trouble. Frequently refacing the working surfaces of these electrodes is excellent insurance against poor welds (Fig. 3).

All electrodes and welding dies should be cooled by some method. If water is used as a cooling agent, a full flow should always be maintained while the machine is in operation.

Clamps and Fixtures—The accuracy of the welded assembly can only be as good as the fixture holding it in place during the welding cycle. It is evident that close inspection and frequent adjustment of the fixtures must be made.

Motors and Drives—Motors, variable-speed drives, clutch and reduction units, and transmission gears and shafts, being essential to the proper operation of the welder, should be inspected and adjusted or overhauled as often as necessary, the frequency depending on the production load required.



FIG. 3. Working surface of circular disk electrode being refaced on lathe.



FIG. 4. Seam-welding machine being lubricated.

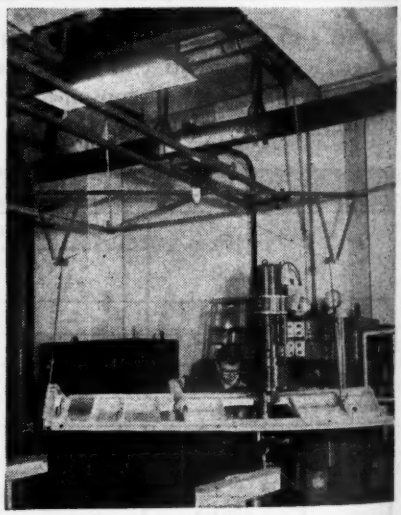
Oiling—All moving parts must be oiled and greased at regular intervals to assure smooth, even motion and minimum wear (Fig. 4). Avoid dropping oil or grease on any of the electrical wiring or connections.

Pressure—All welding machines have some device for establishing welding pressure. Usually this consists of an air or hydraulic cylinder, or a cam or toggle with spring arrangement. This system should be inspected periodically and kept in perfect condition at all times. All air and oil filters should be cleaned at regular intervals.

CRANE BROADENS SPOT WELDER APPLICATION

INDUSTRIAL

One of the main limitations on the use of spot-welders has been the size and weight of assemblies that can be handled. Parts that become too heavy or too bulky for the operator to manipulate require fabrication by the less productive method of riveting. However, the Glenn L. Martin Company of Baltimore has broadened the application of their spot-welders, to take advantage of the more highly productive welding equipment, by designing a handling system for use at each welder.



***CRANE-TYPE SUPPORT** for large assembly fabrication by more highly productive spot-welding equipment. Heretofore large assemblies required riveting.*

The vehicle to this broadened scope of activity has been the installation of an overload crane-type support for handling such parts as bomb-bay and wheel-well doors.

The support is of extremely simple construction as can be seen in the accompanying photograph. Both trolley



HERE'S THE MAN TO SEE ON POST-WAR MOTOR CONTROL PROBLEMS

One of your post-war reconversion problems may be motor control. And that's where your Monitor Field Engineer can help. To be sure of planning your requirements on a sound, economical basis, call him in and let him plan right along with you. He's so thoroughly versed in all phases of electric motor control that he'll be able to offer suggestions which should save you money . . . increase the over-all efficiency of your post-war motor control set-up.

You can have the utmost confidence in the recommendations of Monitor Field Engineers because they represent an organization which has faithfully served the electrical industry for over 56 years—from plans, through design and fabrication, to installation.

There's a Monitor Field Engineer in your locality who will be glad to meet with you at your convenience.

Monitor

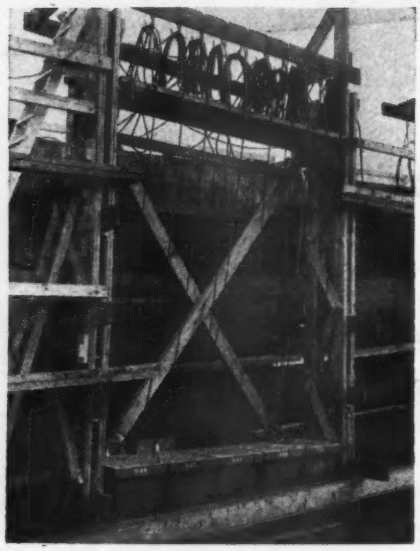
The Monitor Controller Company

GAY, LOMBARD and FREDERICK STS. ● BALTIMORE 2, MARYLAND

Engineering Representatives: BIRMINGHAM, ALA. • BALTIMORE, MD. • BOSTON, MASS. • COLUMBUS, O. • CHICAGO, ILL. • CLEVELAND, O. PHILADELPHIA, PA. • CHATTANOOGA, TENN. • DETROIT, MICH. • KALAMAZOO, MICH. • LOS ANGELES, CAL. • NEW YORK, N. Y. CINCINNATI, O. • HARTFORD, CONN. • BUFFALO, N. Y. • ST. LOUIS, MO. • WASHINGTON, D. C. • HOUSTON, TEXAS.

Canadian Affiliates: CANADIAN CONTROLLERS LTD. . . . . TORONTO, ONTARIO, CANADA.

and bridge rails are fabricated of hollow square steel. The bridge can be moved back and forth in front of the welder; and the trolley, which rides on the bridge, moves into and away from the welder. The trolley consists of a thick plate steel bed with four wheels and provides a pivot point for 360° rotation of the supporting horizontal balance beam. The assembly to be spot welded is suspended from this beam by springs attached by means of quick-acting clamps. Counter-balancing provides for easy handling, and all moving parts have been designed for effortless moving of the crane-support and assembly in a lateral direction or at right angles.



CABLE RACKS are placed conveniently at top deck level so that welders can make their adjustments below at the grid boxes mounted in the scaffolding, proceed on up the ladder to the cable rack and on board to their point of operation. This is at the Bethlehem-Hingham shipyard, Boston.

PORTABLE LIGHT WITH PLUG AND CLIPS

MAINTENANCE

In order to secure light in the many out-of-the-way places he gets into, Carlton Tanner has equipped his trouble-shooting light with both a plug and rubber-jacketed clips. Tanner, who does a lot of commercial and industrial maintenance and trouble shooting, is shop foreman for Marvin W. Gleason's motor repair shop in Binghamton, N. Y.

The light is equipped with a spring clamp so that it may be quickly placed whenever and wherever light is needed. The plug may be used where receptacles are available, but very often none are within reach. Since most of the maintenance is on electrical equipment, a switch box or breaker is generally close enough so that a connection with the clips can be obtained from a hot line to ground. Where work is being done on 440 volt equipment, magnetic breakers are generally provided with 110 volt control circuits so that connections for the portable light are generally available.

The idea is a simple and oft-used one, and can come in very handy at the most unexpected moment. It is another tool in the troubleshooter's bag of tricks to enable him to cope with practically any emergency situation.



***TROUBLE SHOOTER'S** portable light equipped with both a plug and spring clips to get light quickly in out-of-the-way places. Spring clamp on light permits the trouble-shooter to place the light quickly whenever and wherever he needs it.*

MORE WORKING SPACE IN JUNCTION BOX

WIRING

A new type plastic electric junction box which is considerably lighter and far easier to assemble and maintain than the standard aluminum alloy boxes now in use in aircraft manufacture has been developed by the Glenn L. Martin Company of Baltimore, and will soon make its appearance in forthcoming Martin models.

Developed by Harry Cramer, an engineer on the PBM-3 Mariner project, the new box reverses present practice by using a flat plate as the main section to which installations and wiring are attached, and a molded cover of Plexiglas or some other transparent plastic. With the type of box now in use, all installations are made in the box proper where they are far less accessible during assembly and maintenance than on the new unobstructed flat surface.

Still another time-saving improvement made possible by the new design is the sensitizing of the base plate and the reproduction thereon by a photographic process of the wiring diagram. This not only greatly simplifies drilling, assembly and wiring of the boxes in the factory, but in addition provides a permanent record for the use of maintenance.

The design of the new box provides for the use of either a metal or laminated plastic base, depending on whether or not ground studs are needed in the assembly.

The transparency of the cover adds still further to the man-hour savings which the new type box will make possible, both during manufacture and in the field. Today for example, with the old-type metal box now in use in the center wing section of the PBM-3 Mariner, it is necessary to remove and replace the cover 23 times for visual inspections between the original installation and the turning of the airplane over to ground test. This operation is repeated countless additional times in the field, yet with the transparent cover can be completely eliminated.



***HARRY CRAMER** of the Glenn L. Martin Company engineering department with the new type electric junction box which he developed.*

Weight as well as time savings with the new box will be considerable, ranging as high as 33 percent per box depending on the type of box and the material from which the base in made. In the case of a plane similar to PBM-3 Mariner, which uses approximately 100 boxes in its various electrical systems, this would result in a net weight saving of 35–40 pounds as well as a marked reduction in material and manufacturing costs.





The name "U.S. ROYAL" has long been reserved by this Company for rubber products of exceptional quality.

U.S. Royal Cords and Cables, as an example, have been known for many years for their balanced construction, flexibility, dielectric strength, smoothness of finish and physical toughness.

Now comes a new development in rubber technology, greatly speeded by critical war-time needs... a new insulation material, "Safety-Tested" for every desired quality. This has been successfully embodied in the new line of U.S. ROYAL CORDS and CABLES... a line that offers to the electrical industry the assurance of long, economical, trouble-free service... a line truly worthy of the name "Royal".

Serving through Science

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.



Answers to Many Pushbutton Control Problems

Cutler-Hammer's New Wide Range Line of Heavy Duty Pushbutton Stations offers an Unlimited Variety of Functional Combinations

● Now Cutler-Hammer offers a new line of Heavy Duty Pushbutton Stations (NEMA Type 1) for surface mounting and for flush mounting. The surface mounting enclosures accommodate from 1 to 8 Cutler-Hammer new unitized pushbuttons; the flush mounting constructions accommodate from 1 to 3 C-H unitized pushbuttons. The line provides the widest selection of functions and combinations available today and permits these stations to be "tailored" to your exact needs.

Among the many advanced engineering features are the following: one to 4 circuits for each pushbutton; wide variety of operators; big buttons for gloved-hand operation; projecting shatterproof color caps for 180° visibility; fitted "flange-seal" covers for extra sturdy and tight enclosure; rugged yet light weight construction; ample internal free space for easy wiring despite small size; no sharp corners or edges; excellent appearance; optional padlocking feature. Stations may be mounted horizontally or vertically. Write for further details today. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

SOME OF THE OUTSTANDING FEATURES OF THIS LINE

Wide choice of operating elements with one to 4 circuits each, indicating lights, selector switches, etc.



CUTLER-HAMMER
MOTOR CONTROL
C-H

FIBRE DUCT PROTECTED WHILE DRILLING CONCRETE

CONSTRUCTION

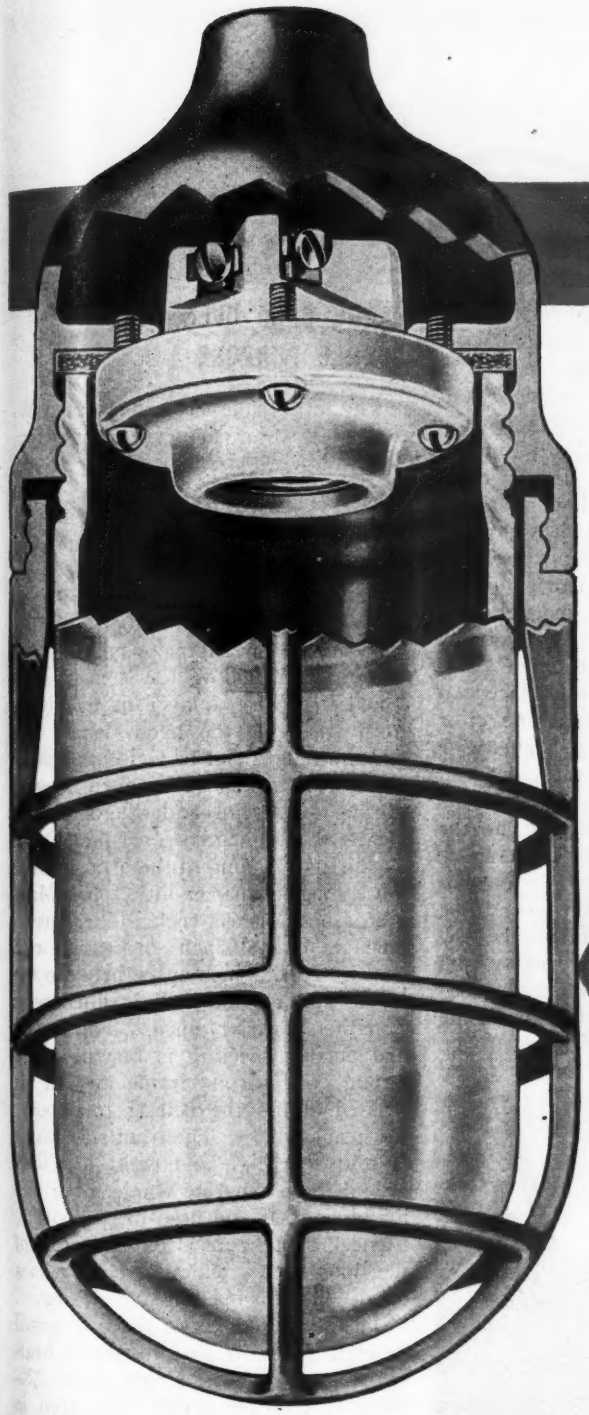
By C. A. WELLS

It is quite evident that the scheme described in "Head Set Warns Operator Drilling Concrete" in the July issue will not work on fibre or any non-metallic duct lines, and in our work, we have many occasions to use these materials. To take care of this condition we have adopted the practice in all of our construction jobs of laying a wire mesh, preferably a close mesh, such as expanded metal, over all fibre duct lines located in floors, walls, or places where they are liable to be disturbed when making additions or alterations. This mesh is placed over the duct line and about three inches away from the duct in the concrete envelope which we always use to enclose our fibre duct lines. The mesh need only be placed on the face which would be endangered by cutting at a later date. The various pieces are wired together with tie wire throughout the length of the line and several ties to ground are made.

The fibre duct now has the same protection that the iron conduit has and the drill operator must stop and drill by hand or very carefully pick his way until he has found what caused the signal. We did not like to muffle the workman's ears with head-phones, from a safety standpoint, and found that a loud buzzer in his pants pocket was just as effective. He cannot hear this buzzer but will quickly sense the vibration from it. We also found that it was much better to tie to building steel for our ground avoiding the possibility of insulated joints which might be in the conduit run. Of course, if the grounding of building steel is forbidden this cannot be done.

Another similar device which we have used successfully is the exploring coil as a means of locating buried steam and water lines running from building to building by applying an interrupted current to the line in question and then using the exploring coil in the yard to mark the course of the pipe under the ground. By an interrupted current I mean a current which is interrupted, or opened, periodically giving a definite beat in the listening-coil detector circuit. This signal will increase or decrease as the exact location of the pipe is found and it is possible to mark on the ground the exact location for the excavation.

Editor's Note—The method referred to above employed a buzzer and battery connected to a headset. When the drill contacted a grounded pipe a circuit was closed to warn the operator.



Vaportight
Industrial Lighting
CONDULETS

(CONDULETS are made only by CROUSE-HINDS)

For boiler rooms, shower rooms, powerhouses, tunnels, docks, building entrances, and all indoor or outdoor locations where exposed to vapors, moisture, rain, smoke, or non-explosive dust and gas.

Vaportight and raintight.

Wiring chamber remains vaportight even though globe is off.

Screw guard or clamp guard types.

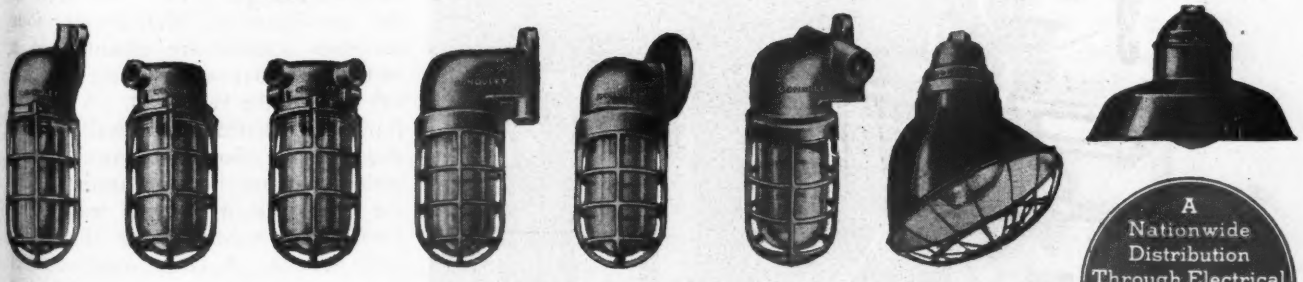
12 Hub arrangements.

4 Reflector styles.

Accessories: colored globes, guards, half shades, adapters.

4 Sizes: 50 through 500-Watt.

Other ***Vaportight*** lighting fixtures are available for attachment to many round-base Condulets and sheet steel outlet boxes. Crouse-Hinds complete ***Vaportight*** line includes hand lamps, switches, plug receptacles, and other electrical devices.



A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
SYRACUSE 1, N. Y., U.S.A.

Offices: Birmingham—Boston—Chicago—Cincinnati—Cleveland—Dallas—Denver—Detroit—Houston—Indianapolis—Kansas City—Los Angeles—Milwaukee—Minneapolis New York—Philadelphia—Pittsburgh—San Francisco—Seattle—St. Louis—Washington. *Resident Product Engineers:* Albany—Atlanta—Charlotte—New Orleans

CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

MOTOR SHOPS

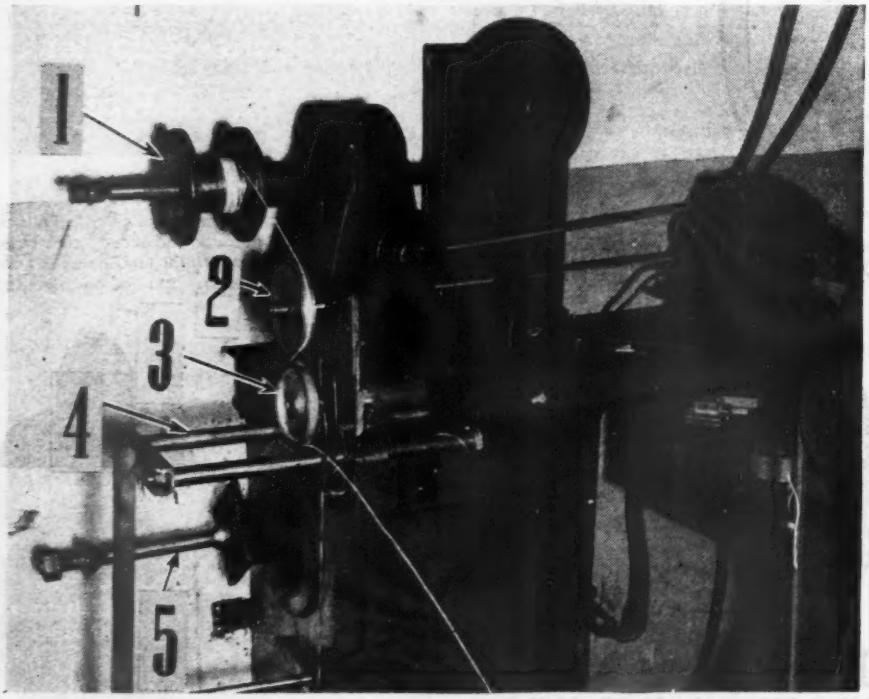
MAGNET WIRE REWIND MACHINE

There's not a foot of magnet wire that goes to waste in the motor service shop of the San Antonio Armature Works, San Antonio, Texas. Partially used spools and reels containing undetermined amounts of wire are measured and rewound on empty reels and tagged for future use. And it's all done in a jiffy by a machine, designed and built by company owner H. S. Foster, which automatically measures the wire as it is wound on the empty spool.

Heart of the unit is a gear box fashioned from an old War I hand generator set from which the generator armature has been removed. Through this 15 to 1 ratio gear reducer, a V-belt connected, foot-pedal operated, variable speed ¼ hp., 3-phase, 220-volt, 1800 rpm. motor drives the empty reel spindle (upper spindle in attendant photo).

A combination tension and measuring mechanism, which slides back and forth at bench level, is attached to the unit. The device consists of two pulleys—each approximately four inches in diameter—mounted to a vertical supporting plate. The groove of the top pulley, which is connected to a counter, was turned down until its perimeter equals exactly one foot. Directly under this is a second pulley which is purely a tension device and guide for the wire which passes over the measuring pulley. A wire loop guides the magnet wire onto the bottom pulley. The partially used wire spools are mounted on a portable reel rack which is placed on the floor in front of the machine. For rewinding large and heavy magnet wire reels, a heavier spindle on the pedestal of the unit is used.

The measuring mechanism of the unit is also used to count the number of turns on small transformer and no-voltage release coils that are to be rewound. The coils are fastened to the spindle of the measuring pulley and then stripped. The number of turns stripped off can be read directly on the counter after the job is finished.



REWIND MACHINE to measure wire on partially used magnet wire reels at the San Antonio Armature Works has the following salient features: (1) empty spool spindle attached to gear reducer; (2) measuring pulley-perimeter equals exactly one foot—attached to counter; (3) guide and tension pulley; (4) slide rails for measuring mechanism; and (5) heavy spindle for large magnet wire reels.

LARGE BAKE OVEN SERVES DOUBLE PURPOSE

The large bake oven in Marvin W. Gleason's motor shop at Binghamton, New York was built originally to dry refrigerator coils. Motor and transformer coils were baked in an auxiliary oven. However, as the volume of motor repair business increased, the old oven was abandoned and now the large 4- by 4- by 8-foot oven is used mostly for baking insulation.

Four-inch hollow tile serves as a foundation with a layer of fire brick to provide for the oven floor. For added strength and to facilitate sliding motors in and out of the oven, lengths of angle-iron are laid diagonally on about 10 inch centers (see photo).

The inside lining of the oven, including ceiling, is quarter-inch Johns-Manville asbestos sheet-rock. The outside surface is half-inch ordinary wall board. A four-inch space between the inside and outside wall is filled with Zonalite granular mica. The inside and outside sheeting is fastened to a strong angle-iron frame which is trussed across the ceiling to support the insulated top. The front side which is four feet high and eight feet long is built on a separate frame fitted into a sliding riser and used for a door.

Steel cable runs from the top of the door over a pulley and down to a hand-winch for opening and closing.

The 128 cubic feet of space is heated by eight 500-watt cone resistance heaters connected across single phase, 220-volts in multiple series. As seen in the accompanying photograph, four porcelain sockets are mounted in a rectangular flat steel frame on the left side of the rear wall. A similar frame is fastened to the wall several feet directly above the lower frame which contains the four heaters. On the right side of the rear wall is an identical arrangement for the other four heaters. A large sheet of steel (removed for the photo) is fastened to these frames to form a baffle with six or eight inches of space at both top and bottom. Thus a natural recirculation of heat takes place keeping a uniform temperature throughout the entire oven space.

An automatic temperature-regulating thermostat will maintain any preset

IRV-O-VOLT TUBING



VARNISHED inside and out...

TO GIVE YOU THESE 5 PLUS-FACTORS

More than flexibility . . . more than ordinary insulating values . . . are offered in the IRV-O-VOLT line of Varnished Tubing. One reason why: Every length is varnished inside *as well as out.*

This extra *inside* coating means that IRV-O-VOLT . . .

- **Saves assembly time because of greater inside smoothness.**
- **Offers unusually low moisture absorption.**
- **Cuts clean without feathering of braid.**
- **Prevents wicking action when used in oil-filled transformers.**
- **Provides a margin of insulating protection even when outside coating has become chafed.**

At ordinary operating temperatures, all types of IRV-O-VOLT tubing retain their flexibility for extremely long periods. In semi-rigid or rigid installations, they will withstand considerably higher temperatures.

For detailed information, or samples, write Dept. 96.

THE A, B, C OF IRV-O-VOLT SELECTION

Choose TYPE A-1 where exposure to high temperature cannot be avoided. Average dielectric strength — 7000 volts, 5000 volts minimum.

Choose TYPE B-1 where average dielectric strength of 4000 volts, 2500 volts minimum, is sufficient.

Choose TYPE C-2 to insulate the leads of armatures and field coils later to be dipped in varnish. Average dielectric strength—1500 volts, 800 volts minimum.

Choose TYPE CT for extra mechanical strength. A saturated sleeving of special heavy walled construction.



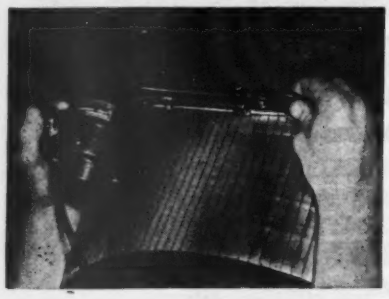
Wires between motor housing and coating are insulated with IRV-O-VOLT Flexible Varnished Tubing.

IRVINGTON VARNISH & INSULATOR COMPANY

IRVINGTON 11, N. J.

RESINS · EXTENDERS · PLASTICIZERS · EXTRUDED PLASTIC TUBING

HULLHORST UNDERCUTTER



PORTABLE NO. 62

• Here is a light weight—compact—handy—portable mica undercutter ideally suited for industrial maintenance men and motor repair shop crews.

LIGHT WEIGHT—weighs only 4 lbs.

COMPACT — Gets into smaller spaces.

CAPACITY — Undercuts horizontal commutators up to 30" dia.

MOTOR—Light, powerful, ball bearing equipped.

SMALL CUTTER — Allows smooth operation, gets closer to riser—lower cutter cost.

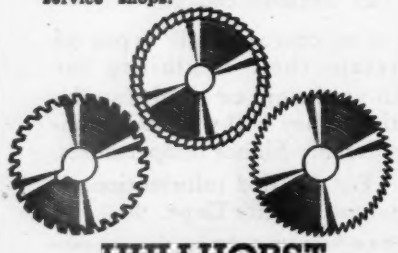
BLOWER—Ample for blowing mica dust away for best visibility.

SIMPLICITY — Fewer parts than most undercutters—no flexible shafts to give trouble.

The price of the No. 62 Undercutter with 110 Volt Universal DC motor or 25 to 75 cycle AC includes carrying case, bar, screw driver and 20 Hullhorst High Speed Steel (¼") Cutters — 4 each of .015", .025", .030", .035" thickness or assorted as you want them. Also furnished with 220 Volt Universal motor at slight increase in price.

HULLHORST Mica Undercutter No. 10

A compact, high production, undercutting machine, handling armatures up to 6½" in dia. and shafts up to 17¾" long. Built specifically for manufacturers and large electrical service shops.



HULLHORST High Speed Steel Commutator Saws

An adequate supply of all important standard sizes is carried in stock. Specify Hullhorst for — faster cutting — longer life — adaptability to all types of Mica Undercutters. In ordering give diameter, hole, thickness and purpose for which intended.

HULLHORST
MICRO TOOL CO.
Division of
TOLEDO STANDARD COMMUTATOR CO.
2242 SMEAD AVE.
TOLEDO 6, OHIO



INTERIOR OF OVEN showing cone heaters mounted within steel frame. Under normal operation a steel plate baffle with space at top and bottom is fastened to the steel frames giving a natural recirculation of air to provide uniform temperature throughout.

temperature between 100 and 300 degrees F. The thermostat has direct control of the magnetic circuit breaker for the cone heaters.

The oven can be brought up to full heat in from one hour to an hour and a half. Depending upon the size of the motors and the type of varnish used, the thermostat is usually set between 200 and 225 degrees F. for a full overnight baking. Larger motors may take somewhat longer for the heat to penetrate.

The four and three-quarter inches of insulation that entirely surrounds the baking space has proven an excellent investment. The savings realized have been considerable.

COMPENSATING WINDINGS ON D.C. MOTORS AND GENERATORS

BY C. LYNN*

Figure 1 shows a stator of a non-compensated d.c. generator. The main pole has a smooth face and the commutating poles are located between the main poles. The main shunt and series field coils provide excitation for producing the main pole flux. The commutating field coil provides excitation for the commutating pole and must be sufficiently strong not only to neutralize the field strength of the armature, but to force the commutating flux across the commutating pole air gap into the armature for commutation.

Figure 2 shows a stator of a compensated d.c. generator. The construction is similar to that of Figure 1 except that slots are punched in the pole faces of each main pole through which compensating bars or windings extend. These bars are connected in series with each other in such a manner as to be concentric around each commutating pole. In other words, the compensating winding can be considered as turns taken off of the commutating field coil, spread apart, and buried in the pole face, still surrounding the commutating pole. Comparing Figure 2 with Figure 1 it will be noted that the commutating field coil itself has only about half as many turns, with the compensating winding acting as the remaining turns.

---

* *General Electric Co., Schenectady, N. Y.*

FIG. 1
STATOR OF NON-COMPENSATED DC GENERATOR

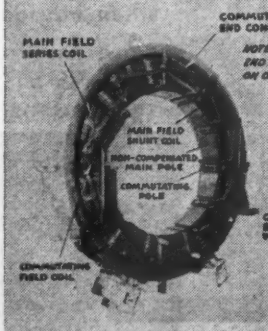


FIG. 2
STATOR OF COMPENSATED DC GENERATOR

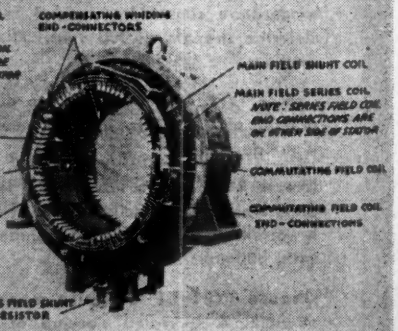


FIG. 3
STATOR OF SYNCHRONOUS CONVERTER

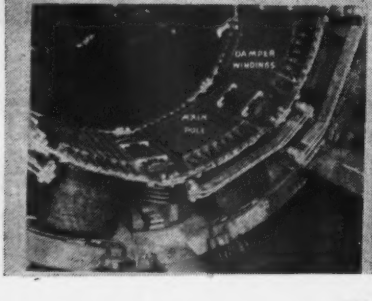
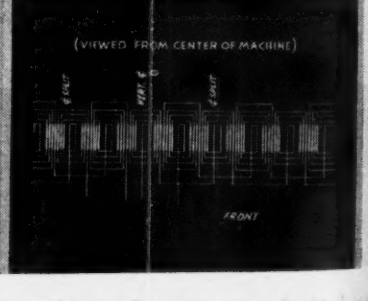


FIG. 4
DIAGRAM OF CONNECTIONS



there'll be Good Money in Bad Air • •

. . . when appliances and equipment can again be manufactured, thousands of home owners will insist on a new Emerson-Electric Kitchen Ventilator . . . Ads like this page, appearing currently in American Home, will guide buyers to Emerson-Electric Dealers.

"Wonder what Mary is serving . . . besides cauliflower?"



An embarrassing moment . . . never experienced by owners of EMERSON-ELECTRIC Kitchen Ventilators

A preview is all right for the movies—but *not* for a meal. There's nothing quite so embarrassing to a hostess as cooking odors in the living rooms. It impairs the enjoyment of well-prepared foods, and many such odors remain long after the meal has been served.

An Emerson-Electric Kitchen Ventilator takes care of this problem quietly, easily and efficiently—whisking cooking odors, excessive heat and greasy vapors out of the house in double-quick time.

If you are planning to build a new home, or modernize your present one, write for booklet describing Emerson-Electric Kitchen Ventilating and Home Cooler Fans.



An EMERSON-ELECTRIC Kitchen Ventilator Is First on Mary's Home Equipment Buying List

Emerson-Electric Kitchen Ventilators will again be available when the Government releases necessary materials and permits manufacturing. Mary and countless other homemakers are planning for cool, pleasant, comfortable kitchens in their peacetime homes.

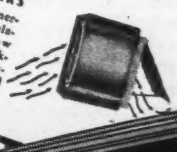
THE EMERSON ELECTRIC MANUFACTURING COMPANY
Saint Louis 3, Mo.
Branches: New York • Chicago • Detroit
Los Angeles • Davenport



Emerson-Electric power-operated gun turrets and electric motors for aircraft contribute to Allied military might on all battle fronts of the world.

HOW IT WORKS

Side view of an Emerson-Electric Ventilator showing how greasy vapors, cooking odors and excessive heat are removed from the home.



EMERSON MOTORS · FANS

EMERSON ELECTRIC

ELEC



On Guard . . .

The AMERICAN HOME

15¢

The Product of the Pioneer



VICTORY LINE

Victory Line of 22 capacitance ratings in electrolytic capacitors for 110-volt operation; 6 ratings for 220-volt.

These 28 universal types can take care of upwards of 90% of all motor-starting capacitor replacements.

Handy Aerovox conversion chart indicates Victory equivalent for any previously available type.

● **It's well to bear in mind that Aerovox was the first to introduce the high-capacitance dry electrolytic capacitor for motor-starting functions. Aerovox has continued its pioneering in this field. Today, faced with wartime restrictions, Aerovox is providing a Victory Line of essential capacitors whereby you can keep those refrigerators going for the duration, at least. Consult our local jobber regarding Aerovox Victory Motor Starting Capacitors. Or write us direct.**

AEROVOX Capacitors
INDIVIDUALLY TESTED

AEROVOX CORP., NEW BEDFORD, MASS., U. S. A.
In Canada: AEROVOX CANADA LTD., HAMILTON, ONT.
Export: 13 E 40 St., New York 16, N. Y. Cable: "ARLAB"

The magnetic field, per pole pitch of the armature, set up by the current in the armature conductors opposes and distorts the main field set up by the excitation of the main pole, in the case of the non-compensated machine. This causes a net loss of main pole flux with load current, giving a poor voltage regulation curve for a generator or a poor speed regulation in the case of a motor. In a compensated machine, however, the compensated windings are so proportioned that they will oppose this armature field, varying in strength with it since the compensating winding is connected in series with the armature. Thus the turns in the compensating winding serve two functions: (1) as part of the commutating pole winding, and (2) as neutralizing turns to oppose and eliminate the armature reaction. By doing the latter, they leave the main field practically undistorted and unchanged in shape and strength and improve the shape of the voltage regulation and speed regulation curves for d.c. generators and motors. The compensating winding also serves another purpose and that is to improve the overload commutating capacity of a d.c. machine by reducing the amount of leakage flux from the commutating pole to the main pole, since these turns lie physically outside of this leakage flux path. Compensating windings add to the cost of a machine and are, therefore, used only in those cases where the performance required justifies its use.

Figure 3 shows the stator of a synchronous converter with damper windings located in the main pole face. The damper windings are bare copper, short circuited upon themselves, and the current in them is produced "inductively" by the magnetic field of the rotor cutting them. The conductors are smaller in size than those of the compensating windings because the duty upon them is much lighter. The compensating winding has to be insulated where it goes through the slots in the pole to stand full line voltage to ground, since this winding is "conductively" excited by being connected in series with the armature of the d.c. machine, thus carrying full line voltage and current.

Figure 4 is a diagram showing connections of commutating and compensating field windings.

EMERGENCY BRASS SMELTER

Like all motor shops, William R. Payne, Payne Electric Company, Houston, Texas, owes much of his success to the service he has been able to render his customers. When parts are not available, he makes them and gets the equipment back into service in the shortest possible time using available shop facilities and characteristic ingenuity.

One of the simple, yet effective, devices he has built to help out in a jam is an outdoor brass smelting furnace. When the local brass foundry is too busy to accommodate him, or is shut down over a week-end, he sets to work making his own bushings—melting down old bushings he keeps for such emergencies.

The furnace is a simple, circular, fire-brick enclosure with an 11-inch inside diameter and a 19-inch overall diameter. Standing 12-inches above the ground, the furnace accommodates a 9-inch deep and 7-inch diameter metal pot with an approximate capacity of



***OUTDOOR FURNACE** permits Payne Electric Co., Houston, to melt scrap brass for new bushings on emergency repair jobs. The furnace is fired with a natural gas and air mixture, stands 12 inches high. Unit is used when factory made bushings are not readily available.*

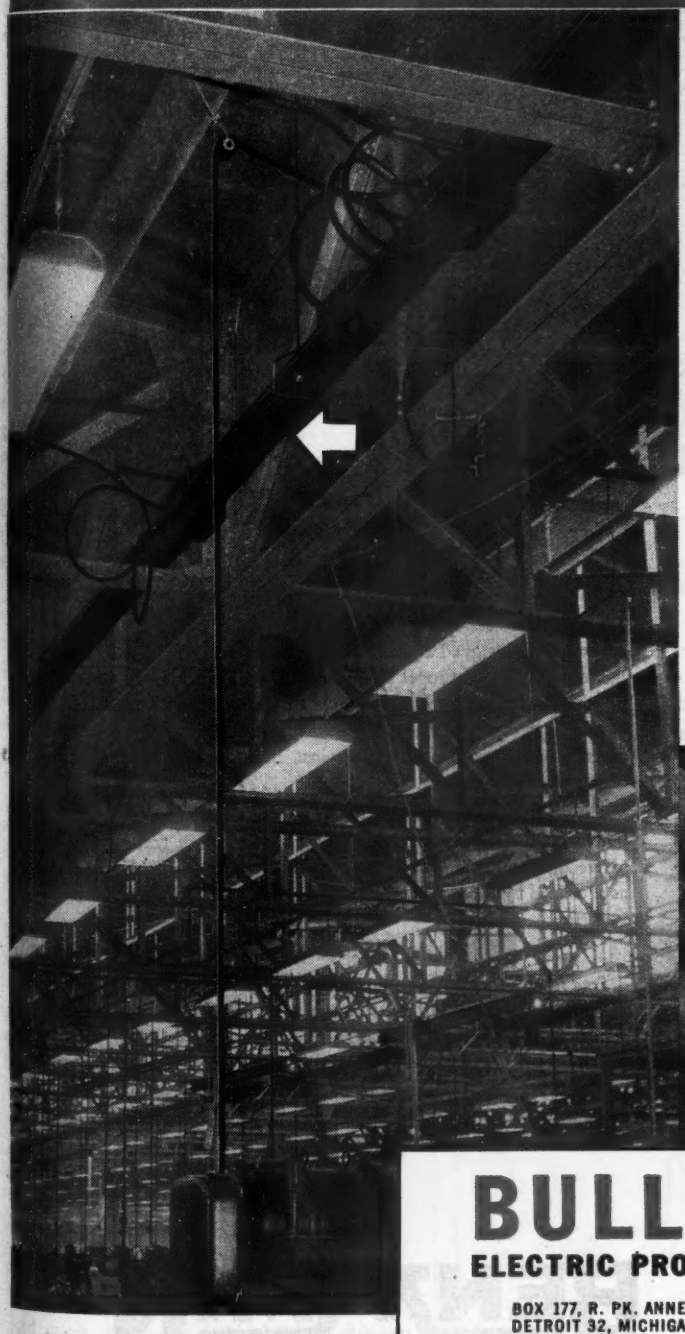
60 pounds of scrap brass. Melting heat is provided by a blast of air and natural gas. The gas line nozzle, coupled to a centrifugal blower and adjusted for proper mixture, is placed inside the brick enclosure where the white hot flame circulates around the melting pot. The furnace cover, made from the top of an old oil drum, is insulated with a 3-inch depth of asbestos. Draft is provided by a 3½-inch hole in the center of the cover. An ice-tong type of device with claws shaped to fit over the melting pot is used to remove it from the furnace.

It takes about 45 minutes to melt down a 60-pound batch of scrap brass. After raking off the slag during the melting operation, Mr. Payne ends up with about 30 pounds of melted brass which he uses to form new bushings for emergency repair jobs.

[Continued on page 165]



... BACK TO PEACETIME PRODUCTS



BULLDOG WILL SPEED RECONVERSION

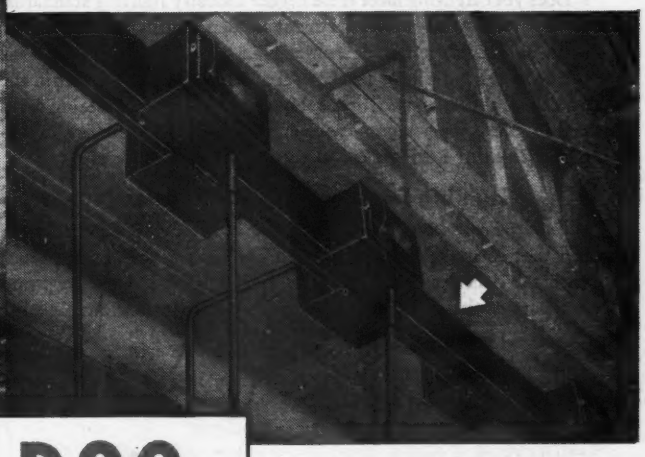
In the great war conversion race, BullDog Electrical Distribution Systems have cut weeks — even months — from change-over schedules. Maintenance time and cost were slashed. Output was stepped up, safety improved.

The reason? BullDog Bus Duct systems make plug-in power for machines immediately available for any shop set-up—furnish mobile power for portable tools, cranes and hoists — provide completely flexible lighting.

Looking ahead, BullDog-equipped plants can also count on speedier, easier reconversion to peace production.

Now is the time to plan for the *reconversion* race. We offer the help of expert BullDog engineers, and will gladly send complete literature.

There's a Big Job Ahead — Buy More War Bonds



ALSO MANUFACTURERS OF
VACU-BREAK SAFETY SWITCHES • SWITCHBOARDS • SAFTOFUSE PANEL BOARDS • CIRCUIT MASTER BREAKERS • UNIVERSAL TROL-E-DUCT • INDUSTRIAL TROL-E-DUCT.

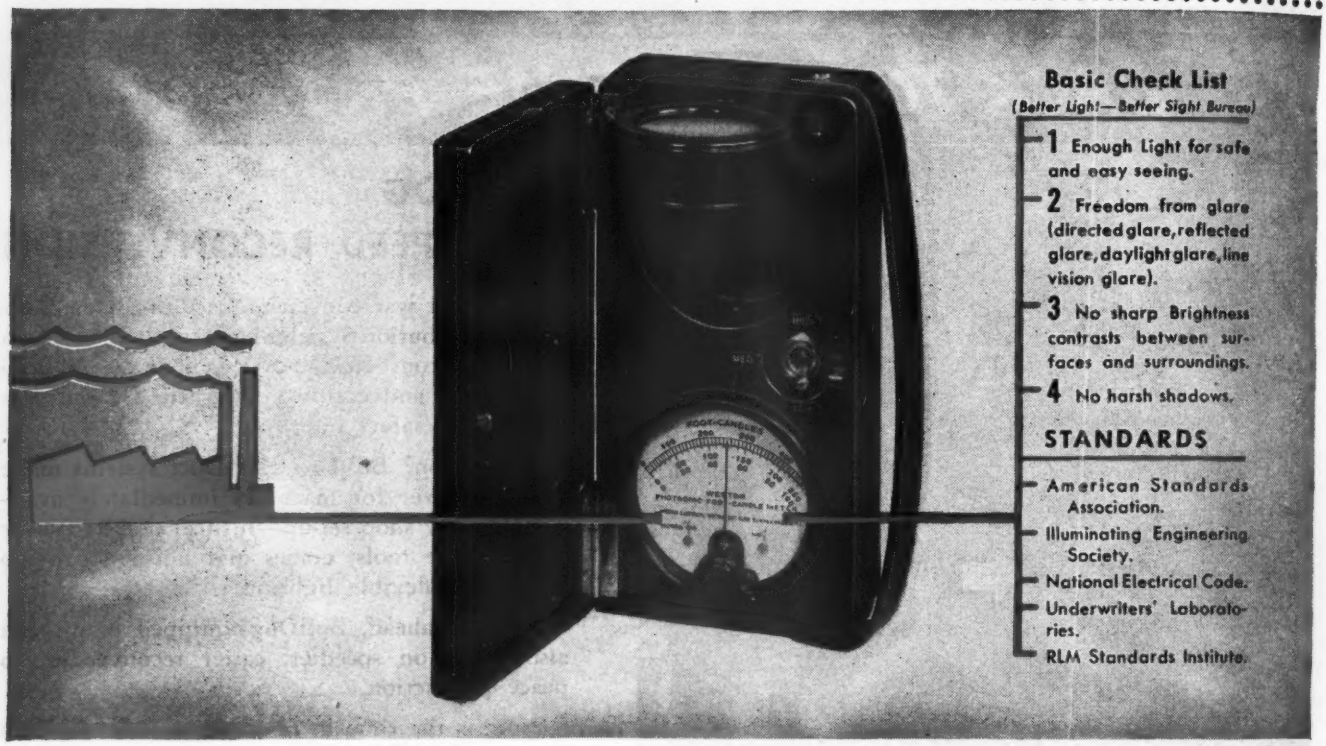
BULLDOG
ELECTRIC PRODUCTS CO.
BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.



Field Engineering Offices in All Principal Cities

BullDog BUStribution DUCT provides complete flexibility on branch power circuits. The plug-in feature enables you to change production machines at will — rearrange whole departments without interrupting production elsewhere.

How far is your Lighting from Today's accepted Industry Standards?



TODAY'S accepted lighting standards in Industry are being proven by war production as essential to higher rates and quality of production . . . to employes' maximum safety, health, and morale.

Does your lighting meet these higher Industry lighting standards? Only a job by job and department by department survey of your plant will enable you to determine your answer. Unless your plant has been newly built or has been completely re-lighted within the past three years, you will probably find that for many seeing tasks and in many departments, your employes have insufficient or improper lighting during most of the day and all of the night.

Lighting Deserves Executive Attention

Executive consideration of the lighting question is indicated by the fact that adequate lighting and comfortable seeing in conformance with the American Recommended Practice of Industrial Lighting is a part of the problem of "general working conditions."

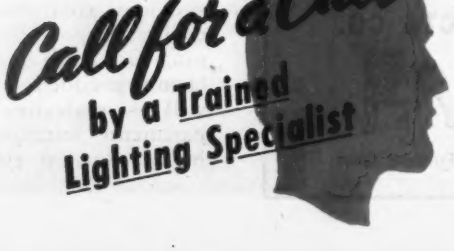
Importance of Fixture Design

To provide efficiently and economically lighting that conforms to today's Accepted Industry Standards requires careful selection of properly designed equipment. To be properly designed, equipment must provide proper shielding of the light source to minimize direct glare, provide the proper direction, distribution and diffusion of the light upon horizontal and vertical surfaces and for certain special locations protection against hazards of explosive gases dust and water vapors.

Through the specification of Benjamin equipment assurance is had of equipment design and construction which conforms with all recognized illumination, electrical and mechanical standards as provided by the National Electrical Code and the RLM Standards Institute.

Write for FREE Booklet

Send for a Free copy of the Booklet "Productive Lighting" containing much valuable information on how to obtain best lighting results. With it will be sent complete information on how you may obtain the assistance of a Benjamin Trained Lighting Specialist in analyzing the performance of your lighting and in making recommendations without cost or obligation. BENJAMIN ELECTRIC MFG. Co., Dept. H, Des Plaines, Illinois.



BENJAMIN TRADE MARK
Lighting Equipment
Distributed Exclusively Through Electrical Wholesalers

Selection and Application of Wound Rotor Motors—II

Details of construction and considerations for obtaining the necessary flywheel effect are discussed with specific reference to the wound rotor motor.

By E. H. Fredrick
Electrical Department
Allis-Chalmers Mfg. Co.
Milwaukee, Wisconsin

ALMOST everyone thinks of the wound-rotor motor as an adjustable speed drive. Possibly the greatest popularity of this type of motor has arisen from the variable speed properties of the motor. However, certain other features are, at times, just as important as the adjustable speed ability of the motor.

Use With Flywheel

Since the slip characteristic on a wound-rotor motor is so easily controlled, as was explained in Part I of this article, this type of motor lends itself particularly well to use in connection with a flywheel. Wherever widely fluctuating loads are encountered, such as on a punch press, the use of a flywheel should be considered. Flywheels are used to prevent sudden changes of speed due to intermittent torque demands of the load. For example, on a punch press, the actual work is practically all done in a very short period of time. During the rest of the time, the motor merely turns over the idling mechanism and overcomes friction.

A typical load cycle for a punch press is indicated in the heavy curve on Fig. A. Note on this curve that most of the time the motor is called upon to deliver only about 40 percent of its rating. However, when the work stroke is encountered, the torque peaks rise as high as 240 percent. A load cycle such as this has two very bad aspects. First of all, if the inertia of the rotating parts is low, the motor may not develop enough torque to pull the machine over the peak, especially if the line voltage should be low at that time. In the second place, the torque demand on the motor is directly reflected in the current drawn from the line. A jagged current curve is not particularly desirable from the power demand standpoint.

Between peaks the load on the motor is very light. Therefore, if some means could be found to remove the peak demand on the motor and to increase the load during the idle periods, several desirable factors could be introduced. The flywheel performs this function admirably.

When the wheel is rotating at a constant speed, its inertia tends to keep it rotating at that speed. Any change in speed on the wheel must be accomplished by application of torque. Obviously, the greater the speed change that takes place during a given period of time, the greater must be the torque applied to or delivered by the wheel. When a flywheel absorbs energy, its speed will increase, and when it delivers energy, its speed will decrease. A change in speed cannot take place instantaneously, and, therefore, the element of time enters into consideration.

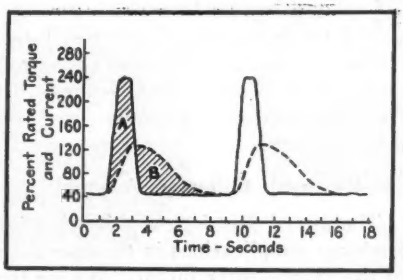


Fig. A Typical load cycle for a punch press drive.

Current Fluctuation Reduced

Referring again to Fig. A. the dotted line shows the torque output of the motor to the flywheel. By a study of the curve, it may be seen that a lower peak extending over a longer period of time has been substituted for the sharp, short load peak. During the early part of the peak load, the flywheel slows down and delivers energy to overcome the peak load. After the load has decreased, the motor must again accelerate the wheel by putting energy back into the wheel. The shaded area under the load peak A in the curve must balance the shaded area B. It is evident that a different flywheel or a motor with different characteristics will alter considerably the shape of the dotted curve. The curve for a smaller wheel would rise higher and terminate quicker, while a large wheel would give a flatter curve.

In any event, the introduction of the flywheel will reduce considerably the torque swings on the motor and consequently the current peaks drawn from the line.

When a flywheel is used on small drives (below 200 hp.), it is usually

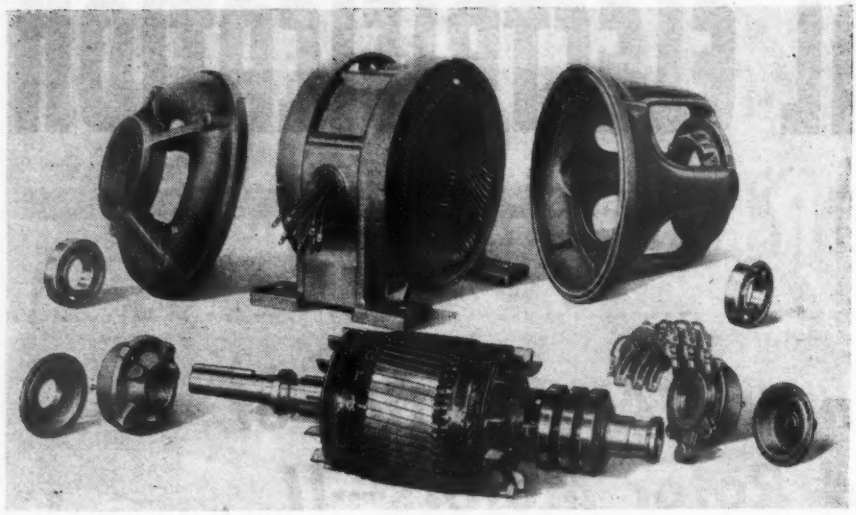


FIG. 1 Exploded view of the principal parts of a wound rotor motor.

made a part of the driven machine, to allow the use of standard motor construction. On very large drives, as illustrated in Part I of this article, the wheel sometimes is mounted on the motor shaft, since the motor is custom built for the job anyway. On small belted drives, the necessary flywheel effect very often is built into the rim of the driven pulley or sheave, thereby eliminating the necessity of having the wheel as a separate unit.

The use of flywheels, of course, is not limited to application with the wound-rotor motor. Certain types of cage motors (known as punch press type) are very commonly used with flywheels. However, the cage motor must be built for this type of service to perform satisfactorily. Any wound-rotor type motor may be applied effectively and easily to a flywheel drive if the proper control is supplied in connection with it.

Construction Features

The main considerations in selecting between a squirrel cage motor and a wound-rotor motor depends on the structural features of each, and a comparison of these features might be pertinent.

Insofar as the stator is concerned, the squirrel cage motor and wound-rotor motor are identical. Fig. 1. shows an exploded view of the principal parts of a wound-rotor motor. As will be noted, the parts which differ greatly from those of a cage motor are the parts directly concerned with rotor construction. In comparison, Fig. 2 shows the construction of the squirrel cage motor rotor. This unit is undoubtedly the simplest and most rugged rotating element of any motor or generator. No leads are required and therefore the solid current paths are as free from trouble as it is possible to make a rotating electrical device.

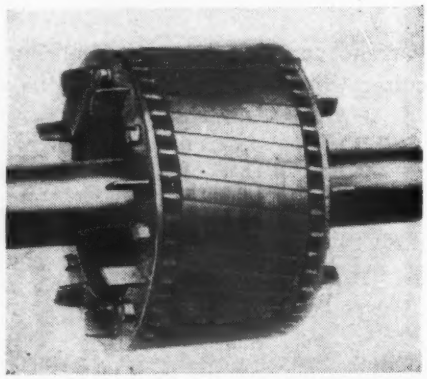


FIG. 2 Construction of the squirrel cage motor rotor.

Since the wound-rotor motor requires external connections to its rotor circuit, means must be provided to bring the rotating terminals to the external control. This feature necessitates the use of slip rings and brushes. A view of a slip ring assembly is shown in Fig. 3.

The wound-rotor motor's collector rings are usually made of cast bronze, as this provides good conductivity as well as good rubbing surface. The rings are assembled on a cast sleeve which, in turn, is pressed on the shaft. The rings are insulated from the sleeve and each other by means of micarta tubes and washers and are so mounted as to secure large creepage distances and free circulation of air around them. The brushes on small motors are usually mounted in holders which are supported by the end housing. On large motors, a separate housing supported by the base is used. Fig. 5 illustrates the construction commonly used on large motors.

Enclosed Collector Assembly

The use of slip rings and brushes introduces complications in the operation of the wound-rotor motor. Where the motors are to operate in dusty locations, it is often desirable to have the collector assembly enclosed. This is done in order to prevent undue wear on brushes and rings where abrasive dust is present and also to obviate the possibility of short circuits between rings where metallic dust may otherwise accumulate between them. The possibility of sparks at the brushes may necessitate the complete enclosure of the rings to minimize fire hazards.

Enclosures and protective devices range from those providing protection from falling particles (drip proof motors) to those effectively sealing the protected elements from the entrance of explosive gases (explosion proof). Fig. 6 shows a motor whose rings are protected against the deposit of dirt and ordinary moisture on the slip ring assembly. Fig. 7 shows a totally enclosed fan-cooled motor, which, with minor modifications, could be made explosion proof. Both these motors are of general purpose ratings (less than 200 hp.). A larger motor with enclosed rings is illustrated in Fig. 8.

The passage of current through the brushes and the brush contact on the rings, as well as the rubbing friction of the brushes on the rings, generates a considerable amount of heat. With open rings the heat is readily dissipated into the stream of cooling air. However, when the rings are enclosed, the heat generated must be conducted

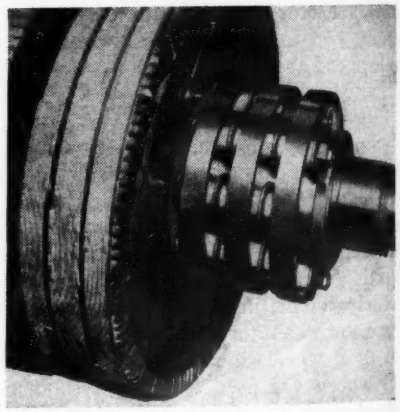


FIG. 3 Slip ring assembly of a wound rotor.

through the enclosing cover and from the outer surface must be radiated into the atmosphere. For this reason, the enclosures are usually ribbed to provide a large radiating surface.

Multi-Speed Motors

Multi-speed induction motors of the squirrel cage type are commonly used in modern industry. With machines of this type, operation at any one of two, three, or four speeds is readily obtained. However, the speed steps are large since the motor will operate at a definite speed on any one of the connections. The simplest multi-speed cage motor is one having a two to one



FIG. 4 Typical method of mounting brush holders in bearing housing.

speed ratio, such as 900/1800 rpm. or 600/1200 rpm. In a machine with these characteristics, a simple stator winding is used, and reconnection of this winding from series to parallel or vice versa provides the operation at the required speed.

If the speed ratio is other than 2:1, or if the motor is to operate at more than two speeds, the stator must be wound with two complete windings. The squirrel cage rotor, in either case, is of standard construction and is identical to that of a single speed motor.

At times it becomes convenient to apply a multi-speed wound-rotor motor to a particular drive. Any one of several reasons may prompt the use of the multi-speed wound-rotor motor. It may be necessary to operate the motor in the unstable range (below 50 per cent of rated speed) of the single speed motor. In this case, the two speed motor would have a zone of stability down to 25 percent of top rated motor speed. If the motor is to operate for long periods of time at reduced speeds, the losses (explained in Part I) will be reduced materially, and, therefore, operating efficiency will be increased by operating on a lower speed connection. Furthermore, with the wound-rotor motor, the speed points definitely may be increased to values between the rated speed points. Sometimes, the item of high torque with relatively low starting current is a factor indicating an application for the multi-speed wound-rotor motor.

The rotor construction on a multi-speed wound-rotor motor becomes quite complicated since a set of three slip rings must be provided for each operating speed. This means that on a two speed motor, six rings must be employed. This construction is shown in Fig. 9. With three speeds, nine

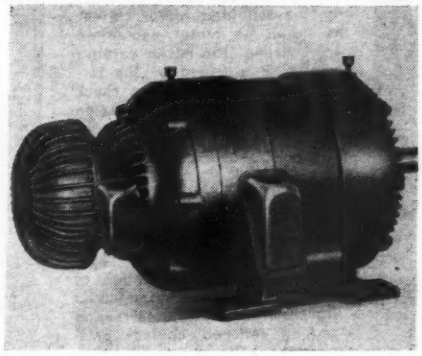


FIG. 7 A totally enclosed fan-cooled wound rotor motor.

rings are required, and since the rigging required for these rings soon becomes cumbersome, it is obvious that most multi-speed wound-rotor motors should be limited to two speeds. If enclosures are required on the slip rings, the construction would be even more awkward.

Dynamic Braking and Plugging

Since most of the losses generated by high rotor currents are dissipated in the external control resistors, the wound-rotor motor is well suited to dynamic braking or plugging duty. In dynamic braking, direct current is supplied to the stator winding after disconnecting the motor from the line, and a portion of the secondary control resistance is allowed to remain in the rotor circuit. The direct current flowing in the stator coils magnetizes the stator, and since the rotation of the rotor cuts the flux, a voltage is generated in the rotor windings. Because the rotor circuit is closed through a resistor, power is generated and a torque tending to stop the rotation is applied to the rotor. Very smooth deceleration is obtained by this method. However, the effective braking decreases as the speed decreases.

In plugging, the phase connection to the stator is reversed with resistance in the rotor circuit. The reversal of the phases causes a reversal of torque, bringing the motor to rest in a short time, since the slowing down torque is effective all the way down to standstill. At rest the line circuit must be opened, or the motor will accelerate in reverse direction.

Summary

The foregoing has been an attempt to give an account of all the important advantages and limitations of the

[Continued on page 100]

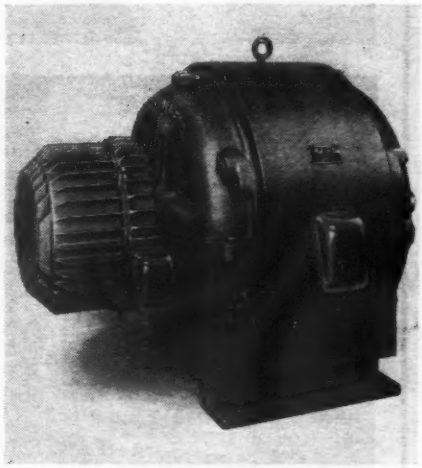


FIG. 8 A large motor with enclosed rings only.

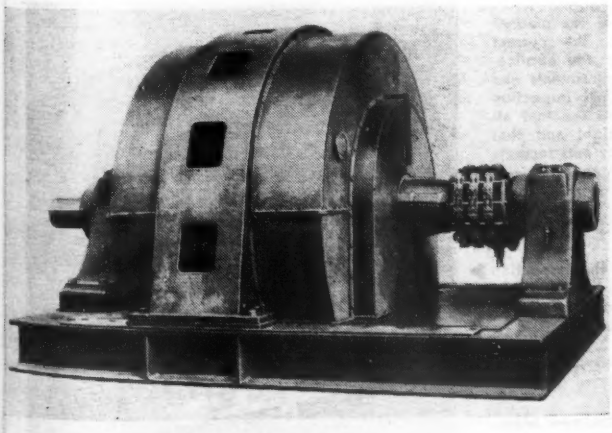


FIG. 5 Brush rigging around the collector rings commonly used on large motors.

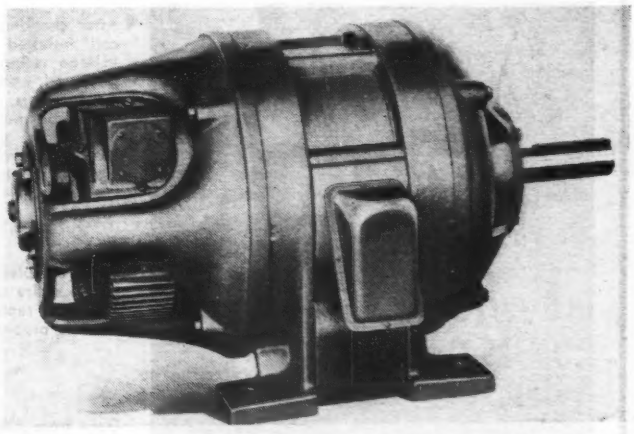


FIG. 6 A motor whose rings are protected against the deposit of dirt and ordinary moisture.

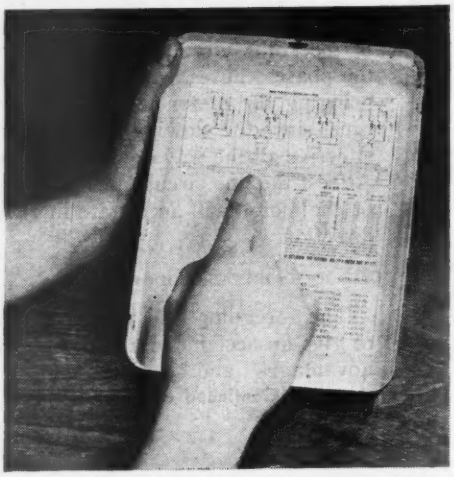
DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index.

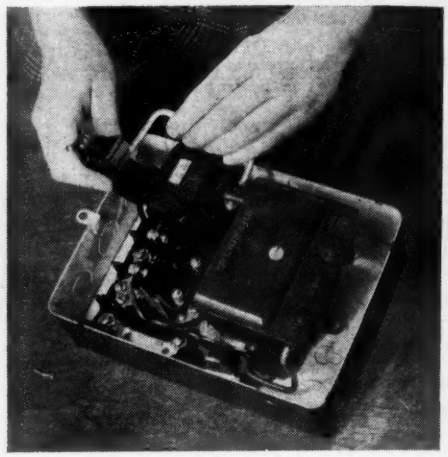
C-3

Motor Starter Maintenance

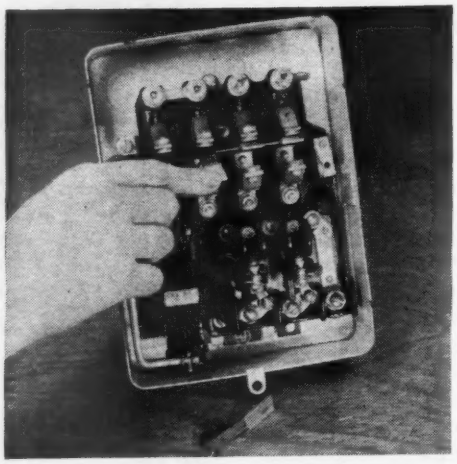
Motor starters now operating at four times their normal peacetime rate should be inspected regularly if they are to continue supplying a steady dependable flow of power to vital war machines. Oil and grease, general causes of motor starter failure found in individual applications, should be eliminated at regular intervals by use of non-combustible solvents such as carbon tetrachloride. Dust and dirt should be removed by suction or air pressure, suction being preferred. In the interest of safety, all circuits should be "worked dead". The illustrations below point out possible starter-trouble spots that should be checked periodically.



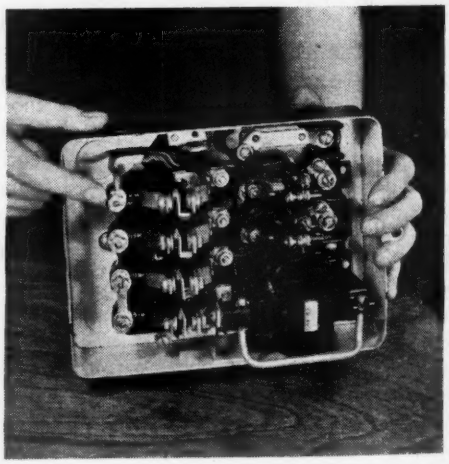
◀ Check with label on the inside of starter cover to make sure that the correct heater elements for the full load motor current as shown on motor nameplate are installed. The heater catalog number is stamped on the terminal of the heaters. Also check that the starter and pushbutton are wired correctly.



The matching faces of the magnet should be free from dust and grime to eliminate "hum and chatter." Accumulation of dirt on these faces will result in vibration and incomplete sealing causing reduced contact pressure. As a consequence, excessive heating of contacts will take place. ▶



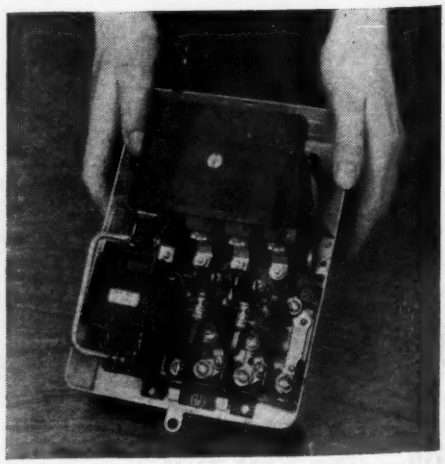
◀ Intermediate fingers and contacts should be replaced in event of excessive wear to insure perfect operation. In cleaning and dressing contacts, a mild abrasive such as a very fine sandpaper shoud be used, rather than a file or emery paper.



Loose connections in any electrical circuit are apt to cause heating. A periodic inspection of all nuts, bolts, screws, and terminals in motor starters is suggested to eliminate as far as possible the chance of overheating. ▶

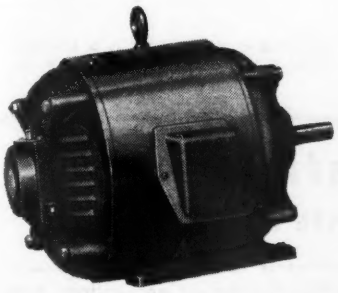


◀ After checking that the magnet coil installed has the correct voltage rating for the application, and, after adjustments and replacements, a final inspection should be made to see that all connections are tight and that the coil is properly and securely mounted on the magnet.

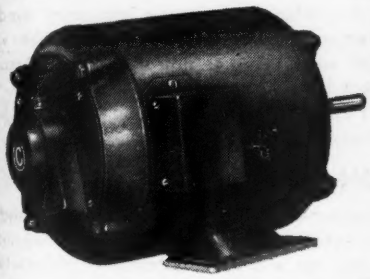


After completing the inspection of the entire unit, the arc shield should be replaced and fastened into its proper position. ▶

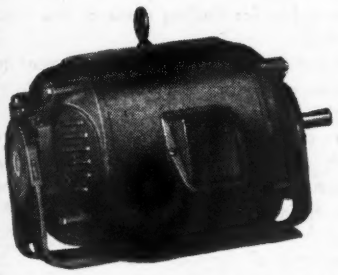
Data from Allis Chalmers Manufacturing Company.



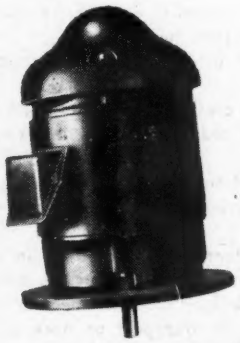
Smooth External Appearance—Type RS, 1½ HP, 1750 RPM, 110/220 volt, 60 cycle, Repulsion Start Induction, single phase, brush lifting motor.



Smooth External Appearance—Type RS motor, ½ HP, 1800 RPM, 110/220 volt, 60 cycle, Repulsion Start Induction, single phase, brush lifting motor. Smooth contour easily cleaned, blends well with the driven equipment.



Cushion Base—Type RS, for 1½, 2, and 3 HP sizes, eliminates the transmission of vibration from the motor to surrounding equipment.



Cover Protects Vital Parts—Vertical ball bearing motor showing cover and vertical mounting.

Insure *Satisfactory Performance*

Of Refrigeration Compressors, Stokers, Pumps, and Other Hard-To-Start Loads *with*

Century Repulsion Start —Induction Motors

Century Type RS, Repulsion Start Induction, Brush Lifting Motors provide the very desirable combination of high starting torque with low starting current.

No other type of single phase motor has such a small drain on the power line in proportion to the size of the load it will start and operate.

These characteristics keep light flicker to a minimum. In addition, these motors are quiet starting and operating, are unusually free from vibration, have a smooth, easy-to-clean frame.

The Century Type RS motors are only one example of the complete Century line of motors for heating and air conditioning use. A Century engineer can give you complete details on any of them, and help you select the correct Century motor for your applications. Call him in today.

Century C MOTORS

CENTURY ELECTRIC CO.
1806 Pine Street, St. Louis 3, Mo.
Offices and Stock Points in Principal Cities

394

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

G-2

Precautions in Use of Instruments

GENERAL

1. Always try to have the instrument reading between 1/2 and 3/4 full scale. Never read below 1/3 full scale if possible.
2. Never touch bare terminals or binding posts while an instrument is energized.
3. The instrument reading should be made from directly above the scale to avoid errors.
4. If a split-core current transformer is used with an ammeter, always make sure that the transformer-core joint is free from dirt which may introduce a considerable error in the reading.
5. To avoid temperature errors, instruments should never be used in extreme temperatures. Special temperature-compensated instruments can be supplied for these conditions.
6. Special instruments should be used to measure motor starting currents or welding currents. For example, a pointer-stop ammeter is ideal for checking motor starting current.
7. Clean the glass of an instrument by using a damp cloth. A dry cloth may induce a static charge on the glass and affect the instrument reading. If the instrument glass does become charged, it can be dispelled by breathing on the glass.
8. Never slam the cover of an instrument. Be sure the nuts of the binding post are tight, even when not in use.
9. If an instrument is overloaded or dropped or, if for any reason the accuracy is doubted, the instrument should be checked against another instrument on several points before it is used again.
10. Tapping an instrument with the fingers will remove any slight stickiness. If the pointer movement is erratic, and if tapping causes appreciable movement of the pointer, the instrument bearings may require attention and should be examined by a competent instrument-repair laboratory.
11. Instrument accuracy is always expressed in terms of the percentage of error at the full-scale point, so maximum accuracy is obtainable by keeping the reading as high on the scale as possible. This calls for the selection of a properly rated instrument. The accuracy of the readings is determined as follows: Assume that there are 100 scale divisions and that the accuracy is one percent of full scale. A scale reading of 100 means that the quantity measured contains 100 units plus or minus one percent, or plus or minus one scale division; that is, the correct value lies between 99 and 101 units. However, while a scale reading of 20 (1/5 of full scale) also has a margin of error of plus or minus one division, the error is five times as great, or plus or minus five percent.
12. Wattmeters should be so connected into a circuit that the current coil and the potential coil are at the same potential. (The potential terminal, which is connected in the same side of the line with the current coil, is usually identified by the zero or + marking.)
13. The above is particularly important where multipliers are to be used, as it is possible to obtain a potential difference between the current and potential coils high enough to cause a breakdown.
14. Instruments with single ratings are preferable because if, by accident, the single-rated instrument becomes defective, the use of only one instrument is lost; whereas if one tap of a multi-rated instrument burns out, the entire instrument has to be repaired. For example, instead of having a voltmeter rated 600/300/150/75 volts, it would be preferable to have two instruments rated 600/300 and 150/75 or better still, to have four separate instruments.
15. When rectifier instruments are used in a.c. circuits to measure a.c. values, the wave form should be known, as rectifier instruments are normally calibrated on sine-wave a.c. circuits.

INSTRUMENTS FOR DOUBLE DUTY

1. A polyphase wattmeter can be used to measure a single-phase circuit within the current and voltage ranges of the instrument, by connecting the two current coils in series and the two potential coils in parallel. Scale reading should be divided by two.
2. When only single-range instruments are available, compact multipliers can be bought or constructed to provide additional ranges.
3. An electrodynamometer and iron-vane instrument can be used on a.c. or d.c. With the iron-vane instrument used on d.c., reversed readings should be taken, the average value being the correct value. A d.c. instrument of D'Arsonval construction cannot be used on a.c.
4. Power factor can be determined in any a.c circuit by using a voltmeter, ammeter and wattmeter.

CALIBRATION

1. How often an instrument should be calibrated depends on its use and the accuracy desired. If calibration standards and equipment are not available, instruments of nearly the same rating can be checked against each other. If wide discrepancies are noted, the instrument which obviously reads incorrectly should be checked by a competent laboratory or returned to the manufacturer.

REPAIRS

1. Unless a competent instrument mechanic is available for making repairs, it is recommended that instruments be returned to manufacturer or to a competent laboratory.
2. The following is a guide for finding some of the more common causes of trouble:
   a. Sticky or jerky pointer——Dirt on scale; pointer touching glass; dirt in air gap of moving element or damping magnet; damaged bearing.
   b. Pointer sticks to stop——Dirt or grease on pointer or stop.
   c. Instrument fails to indicate——Loose or dirty lead connection; poor soldered joint; open resistance spool; open armature; control spring or lead-in burned out.
   d. Pointer cannot be set at zero——Bent pointer or zero adjuster crank arm out of regulator slot.
3. If an instrument element is removed from the case in order to inspect for any of the above causes, extreme care should be taken not to get dirt and dust into the instrument and not to distort or damage any of the delicate internal parts.
4. Instrument bearings should never be oiled.

TRANSPORTATION AND STORAGE

1. Instruments should be stored in a place free from dust, corrosive fumes, and excessive humidity.
2. An instrument should be slid into its carrying case, not dropped.
3. An instrument should preferably be transported face down, or up on one end, in order to remove the weight from the lower pivot.
4. If it is necessary to transport an instrument other than by hand, it should be carried in a padded container which will absorb shocks.
5. Do not carry more than one instrument in one hand. If means have been provided for locking the moving element, this should be done before the instrument is transported.
6. When it is necessary to transport or store a recording instrument, the ink should be removed from the inkwell, the pen cleaned, the moving element locked, and the chart carriage secured.

General Electric Company

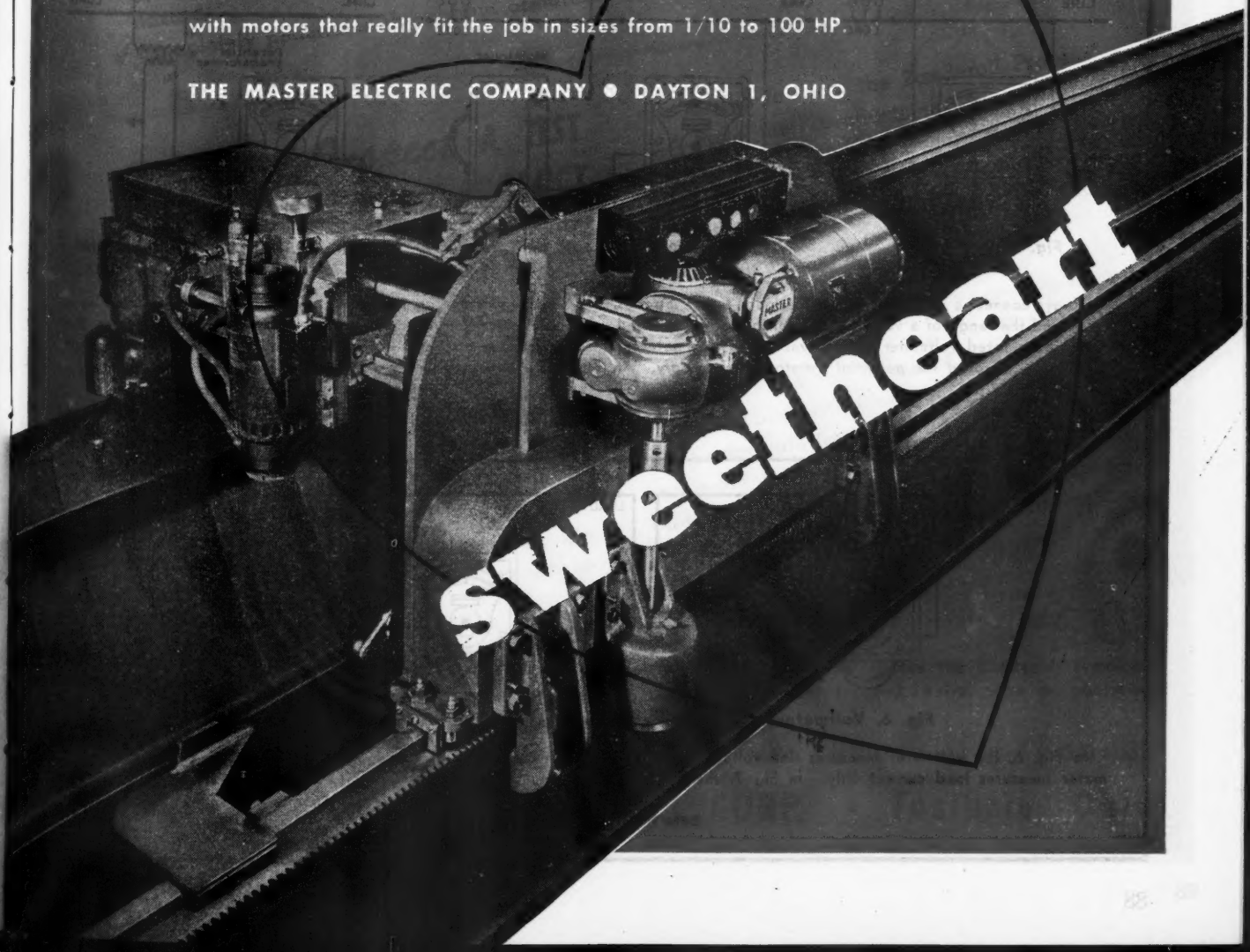
How good a job are you making of your motor applications? Is each job really "a sweetheart" or do they look more like the results of a shotgun wedding?

It's easier to make each job a sweetheart . . . if you take advantage of the wide flexibility of Master motor drives. For instance, look at the application shown below. By incorporating a motor, an electric brake, a mechanical variable speed unit and a gear reduction . . . all designed and built into one compact integral unit . . . this Master motor provides variable speed at exactly the right range and in addition can be quickly and accurately stopped at exactly the point desired. It mounts neatly on the machine, saves space, saves money and greatly improves the output, safety, appearance and convenience of the equipment.

Probably you will not need exactly the same combination of motor features illustrated below, but the Master line includes motors for every current specification, every type of enclosure, and every type of mounting arrangement . . . in fact, is the most flexible, the most versatile line of motor drives in the world.

Investigate Master's unusual ability to serve you economically with motors that really fit the job in sizes from 1/10 to 100 HP.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO



DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

G-3

Instrument Connections

A. C. MEASUREMENTS

AMMETER

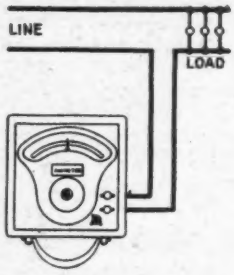


Fig. 1. Ammeter

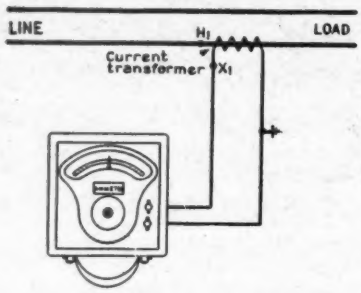


Fig. 2. Ammeter with current transformer

Always connect an ammeter in series with the load—*never across it. Ground the current transformer secondary.* If an ammeter is to be used in circuits of devices such as motors that have a high starting current, short out the ammeter until after the starting period. Or, if the instrument is to be left in the circuit for some time, use a short-circuiting switch to avoid damaging the instrument. The switch can be opened whenever a reading is to be taken.

VOLTMETER

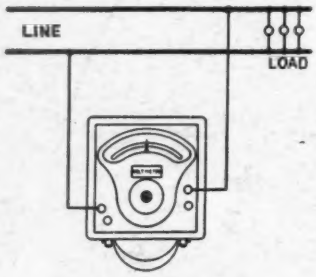


Fig. 3. Voltmeter

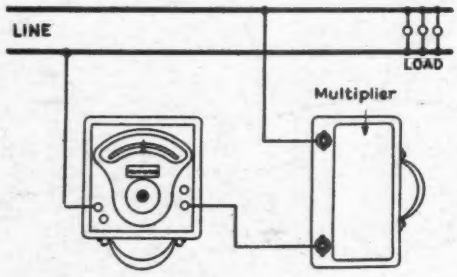


Fig. 4. Voltmeter and multiplier

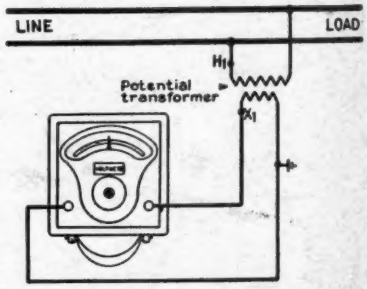


Fig. 5. Voltmeter with potential transformer

Always connect a voltmeter across the load—*never in series.* To extend the range of a voltmeter, a multiplier may be used. If a higher rated voltmeter is not available use a potential transformer. *Ground the potential transformer secondary.* An a.c. voltmeter connected to an inductive circuit (such as a generator-field circuit) should be disconnected before the circuit is opened. Otherwise the inductive kick may result in a bent pointer or other injury to the instrument.

VOLTMETER AND AMMETER

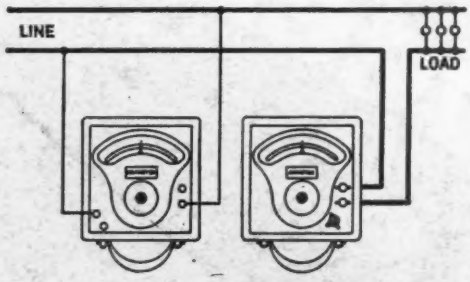


Fig. 6. Voltmeter and ammeter

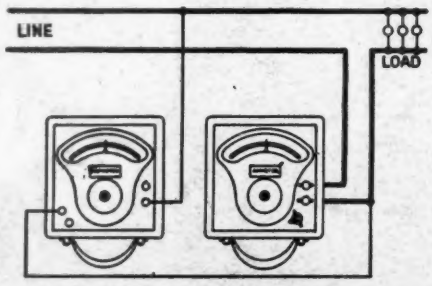
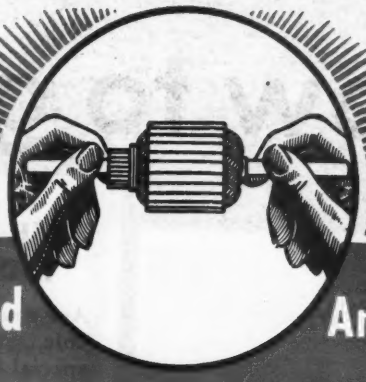


Fig. 7. Voltmeter and ammeter

In Fig. 6, the voltmeter measures line voltage. The ammeter measures load current only. In Fig 7, the voltmeter measures load voltage, not line voltage. The ammeter measures load current plus voltmeter current.

Data from General Electric Co.

Announcing ZANDEROLL*



A Process* of New and Amazing Efficiency for INSULATING ARMATURES AND STATORS

Proven and Guaranteed ADVANTAGES

- ✓ Reduces total treatment time 50% to 90%.
- ✓ Eliminates the costly job of removing unwanted varnish from armature shafts.
- ✓ Eliminates all drainage of varnish after removal of armature from bath. No cleaning of drainboards and oven floors. Less fire hazard.
- ✓ Completely penetrates throughout armature windings. Distribution of varnish is so uniform that armatures balanced before Zanderizing* are in balance after treatment.
- ✓ Thorough and complete bake of varnish insulation assured in less than half the time required by other methods.
- ✓ Improves appearance of finished product.
- ✓ Substantially reduces floor space requirements.
- ✓ Maintains uniformity of production by simple controls and ease of inspection.

See and Inspect A TEST TREATMENT OF YOUR PRODUCT

A pilot plant now in operation provides facilities for test treating armatures and stators up to 5-inch diameter. Manufacturers are invited to view the Zanderoll Process* and have their products test treated. Full cooperation is offered to your engineers to determine and analyze the amazing benefits of the Process* as applied to your particular requirements.

Complete ENGINEERING SERVICE

Through Fostoria Industrial Service Centers, located in twenty major cities, The Fostoria Pressed Steel Corporation, under licenses issued by The Sterling Varnish Company, and in cooperation with Sterling engineers, provides adequate facilities and highly trained engineers particularly qualified to specify and supply necessary equipment and insure proper utilization of the Zanderoll Process*.

*Patent Applied For

For further information and an appointment to inspect the Zanderoll Process* and have your products analyzed and test treated, write, wire or phone—

THE STERLING VARNISH COMPANY • Haysville, Penna.
or THE FOSTORIA PRESSED STEEL CORP. • Fostoria, Ohio

How to get more

WITH G-E LAMPS FOR SPECIAL INDUSTRIAL APPLICATIONS

Are you taking advantage of the many profitable sales opportunities in G-E lamps for special industrial applications? For example:

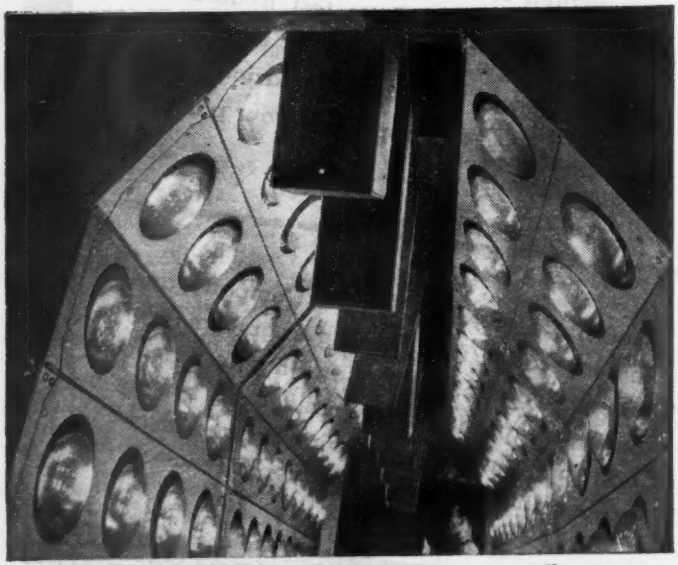
1. INSPECTION. When G-E featured the inspection device at left in a recent ad, hundreds of production men wrote or telephoned for more information.
2. DRYING. Versatile drying tunnels with G-E infra-red heat lamps have solved many a factory's drying problems.
3. VIBRATION. Almost every plant that uses high-speed machinery is a market for G-E Mazda Vibration Service Lamps.

These are just three of the many business opportunities in G-E's full lamp line. It pays to know and sell the complete line!

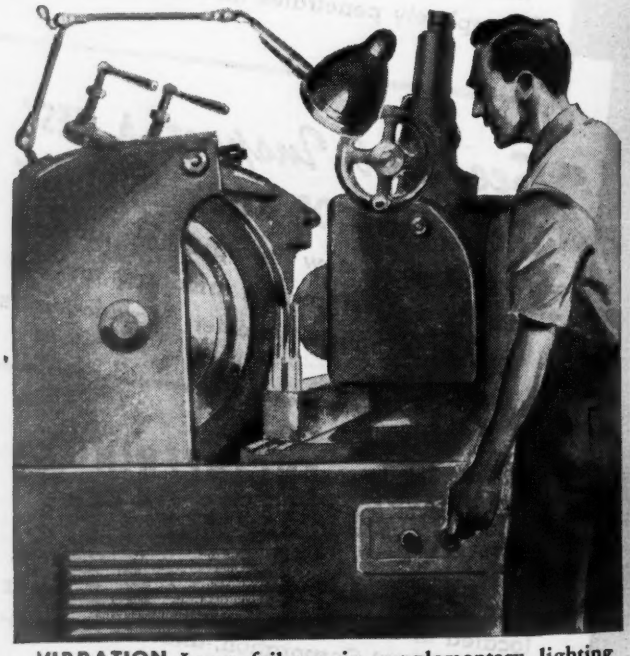


G-E Reflector Lamp throws beam into shell interior

Inspector sees inside of shell in this reflecting mirror



DRYING. Infra-red heat from G-E Drying Lamps offers exceptional results in reduced drying time for many industrial finishing applications.



VIBRATION. Lamp failures in supplementary lighting units on high-speed machinery can often be reduced by using the G-E Mazda 50-watt Vibration Service Lamp.

GENERAL ELECTRIC

Hear the General Electric radio programs: "The G-E All-Girl Orchestra", Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

business with G-E lamps

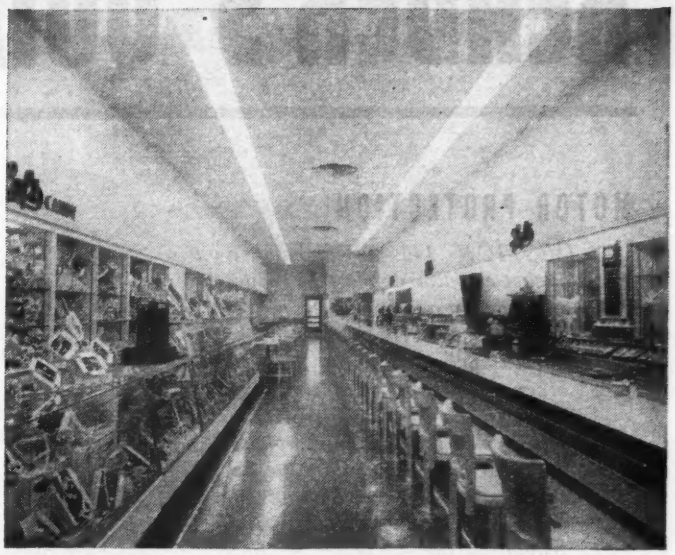
WITH G-E MAZDA F LAMPS FOR FACTORIES • STORES • OFFICES

1. Full quantities of G-E Mazda Fluorescent Lamps are now available! Store and office users of fluorescent lamps who have been unable to secure preferred rating now can get all the G-E Mazda F lamps they need! Here's a big lamp renewal business that pays dividends *now*—don't delay!

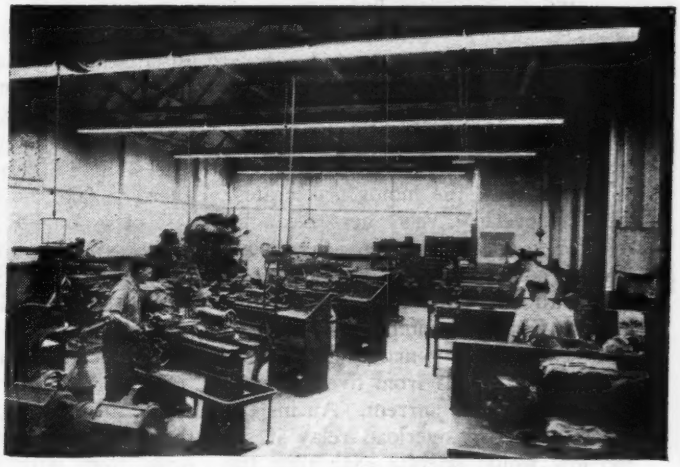
2. The market for new fluorescent installations is developing fast! About 1,500,000 commercial establishments need relighting. Most of them will want fluorescent. Start lining them up now for immediate sales when fixture restrictions are lifted.

3. Fluorescent lighting installed in industrial plants in the past year or two now represents an increasing opportunity for steady lamp-renewal profits.

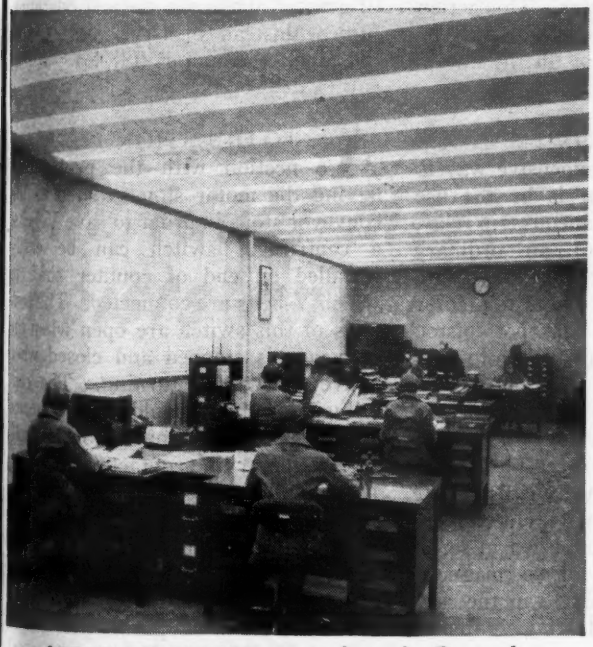
Remember—now you can get quick delivery on both rated and unrated orders for G-E Mazda Fluorescent Lamps. Don't delay!



G-E MAZDA F LAMPS now can be supplied on unrated orders.



FLUORESCENT lamp renewals in industrial plants are a big market.



ABOUT 600,000,000 square feet of office and warehouse space need relighting.



G-E MAZDA LAMPS

KEEP BUYING WAR BONDS—KEEP THE WAR BONDS YOU BUY

QUESTIONS from readers on probems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

READER'S QUIZ

MOTOR PROTECTION

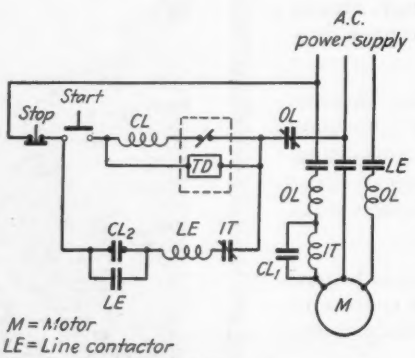
QUESTION 143. We have a bucket elevator driving an induction motor and a V-belt drive. This elevator occasionally blocks due to buckets catching or some other cause and each time this happens the V-belt burns. The motor is 15 hp., 550 volt, 3 phase, 25 cycle with across-the-line automatic starter. Could someone suggest a suitable switch that would cut the motor off, as soon as the elevator blocks and save the V-belts?—W.R.T.

A. TO QUESTION 143. If a time delay relay is used in conjunction with an instantaneous overload relay and an additional contactor to keep the overload relay out of circuit until the motor accelerates, then the overload relay heater can be selected to operate at, say, 125 percent load, (not nameplate rating), and would afford "jam" protection to the motor. Since the motor starts on full voltage, it draws a maximum current each time it starts from five to seven times its full load current. An instantaneous type of overload relay if set too low would operate each time the motor started and shut the motor down. If the adjustment were made too high, it would offer no protection to the motor when it stalled. Since motor doubtless accelerates in several seconds a control scheme as in the diagram will afford the protection desired.

When starting, the sequence of operations is as follows:

1. Pressing the start button (which must be held closed till the time delay relay operates) energizes coil CL of the auxiliary contactor which short-circuits the instantaneous overload relay coil which is in series with motor.

2. As contact CL_2 closes, line contactor operating coil LE is energized, starting the motor. This electrical interlock arrangement is necessary to make sure that the instantaneous overload relay coil is safely short-circuited before starting the motor.



M = Motor
LE = Line contactor
CL = Auxiliary contactor
OL = Instantaneous overload relay
TD = Time delay relay

3. Pressing the start button also initiates a time delay relay which operates after the number of seconds required to accelerate, and opens the short-circuiting contactor. This action places the IT relay in circuit and on guard to take the motor off the line in case of a jam.—R.F.E.

A. TO QUESTION 143. A very simple and inexpensive way to protect this equipment is by the use of the so-called instantaneous trip relay. This is nothing but an ordinary single magnetic overload relay with the coil in series with one of the motor leads, but with the dashpot piston removed so as to eliminate the inverse time element. The position of the core or plunger can be adjusted so that it will pick up only when the load on the motor exceeds a certain amount, at which time it will operate instantly. The normally closed contact on the relay is connected in series with the pilot circuit of the magnetic starter. The only change in the normal operation of the starting equipment is that the start button when starting the motor must be held down until the motor comes up to speed, because this relay will pick up on the starting current, but will drop back when the current has dropped to normal.

This idea of instantaneous tripping is quite valuable for any type of elevator or conveyor which might easily become jammed, and seriously damage some of the equipment. The thing is not 100 percent foolproof however, because it can easily be mis-used, such as some person pushing the button repeatedly even when he knows the conveyor is jammed. Probably the only remedy for such carelessness or ignorance is the use of shear-pins.—P.E.P.

A. TO QUESTION 143. We have completely eliminated our elevator drive trouble by equipping our motors with magnetic motor starters fitted with bimetallic strip type overload relays. This type relay has interchangeable heaters that can be selected to provide the degree of protection desired.

Relay heaters for this service should be selected to trip at a current value 10 percent above the normal operating current instead of basing the heater size upon the motor full load rating. —B.C.M.

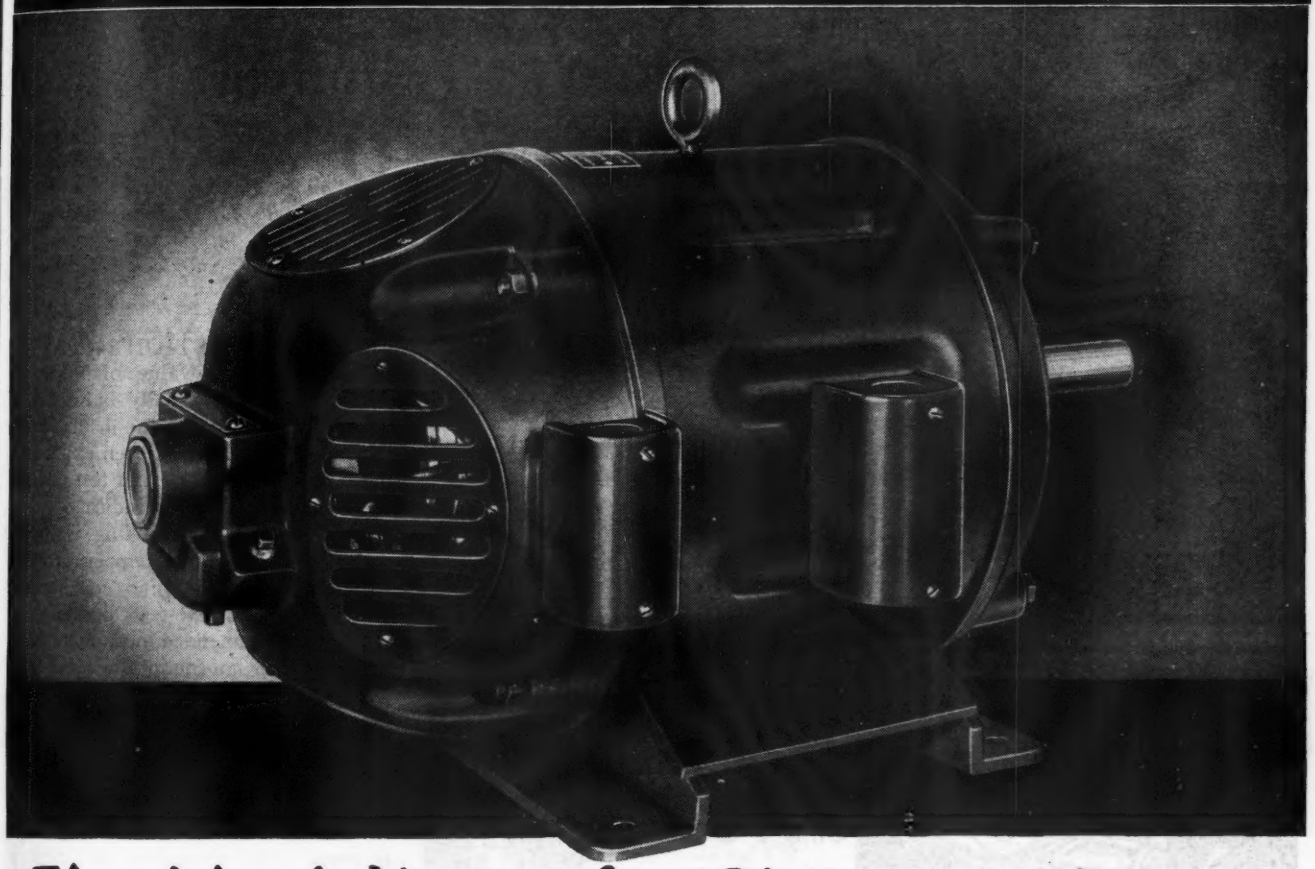
A. TO QUESTION 143. In connection with the problem of having the motor stop as soon as the conveyor stops in order to save V-belts, a centrifugal switch can be easily installed on end of counter shaft to which V-belts are connected. The contacts of this switch are open when the conveyor is stopped and closed when conveyor shaft is turning. The centrifugal switch should be connected in series with the stop button controlling the motor line-contactor so that the power will be cut off if conveyor shaft stops. Of course, it will be necessary to short-circuit these two leads until shaft reaches sufficient speed to close the contacts. This is easily done by another button on pushbutton station (which is a normally open button) held closed by operator when he starts conveyor until contactor is held in by the circuit closing through the centrifugal switch.—L.F.D.

A. TO QUESTION 143. If the motor is correct size for the load and the belt tension is right for pulling the load, there should be no trouble such as mentioned in this ques-

Wagner

SLIP-RING MOTORS

FOR CONTINUOUS OR INTERMITTENT HEAVY-DUTY SERVICE



The Ideal Motor for Elevators, Cranes, Hoists and other Heavy-Duty Service

Here is a heavy-duty motor that is built to "take a walloping" and stay right on the job. Wagner slip-ring motors when operated in conjunction with proper control equipment have these important advantages:

1 Ability to start extremely heavy loads without affecting running characteristics.

2 No abnormal heating with repeated starting and stopping.

3 Variation in starting torque to meet varying torque requirements.

4 Smooth acceleration under heavy loads.

5 Higher starting torque with lower starting current.

6 Variation in operating speed, each reduced speed adjustable for a selected rpm for a given load.

MOTORS
TRANSFORMERS
UNIT SUBSTATIONS
INDUSTRIAL BRAKES
BRAKE LINING

M44-6B

WRITE FOR COMPLETE INFORMATION . . .

ARMY E NAVY

BUY U. S. WAR BONDS

NATIONAL SECURITY AWARD

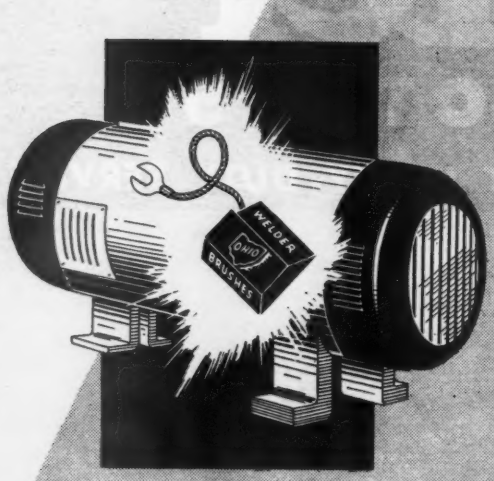
Wagner Electric Corporation

ESTABLISHED 1891

6413 Plymouth Avenue, St. Louis 14, Mo., U. S. A.

ELECTRICAL AND AUTOMOTIVE PRODUCTS

Welder Brushes



ORDER THE RIGHT BRUSH FOR YOUR WELDER FROM OUR STOCK

Keep 'Em Running - Specify OHIO CARBON BRUSHES

Manufactured by **OHIO CARBON COMPANY**

INSULATION AND WIRES SERVICE

Distributed by

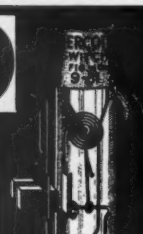
INSULATION & WIRES, Inc.

2127 Pine St., St. Louis 3, Mo. — 30 Trowbridge Ave., Detroit 2, Michigan
289 Simpson St., N.W., Atlanta 3, Georgia — 181 Portland St., Cambridge 41, Mass.
3930 Coleridge, Houston 5, Texas

MERCOID



The Only 100% Mercury Switch Equipped Controls



FOR HEATING, AIR CONDITIONING, REFRIGERATION, AND VARIOUS INDUSTRIAL APPLICATIONS



Pressure Control

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, fluid level or mechanical movement.

Mercoid Controls have many desirable features which have made them favorites among leading industrial engineers.



Temperature Control in Explosion-proof case

DA (Double Adjustment) Temperature or Pressure Controls are used extensively on industrial applications. The outside double adjustment facilitates the control operating range setting. The calibrated dial plainly indicates the desired setting. All guesswork is eliminated. No cover to open or remove when making control adjustments. A locking device is provided to prevent tampering. Various ranges available.

The hermetically sealed mercury switches are dust and corrosion-proof. There is no open arcing, pitting or sticking of contacts. These switches assure better control performance and longer control life.

If you have a pressure or temperature control problem Mercoid engineers will assist you.

See catalog No. 600 for complete information on all types of Mercoid Controls.

THE MERCOID CORPORATION, 4233 BELMONT AVE., CHICAGO 41, ILLINOIS

tion. The question mentions an automatic across-the-line starter. This starter should have the proper overload relays installed for this particular motor and load. If this condition does not exist it should be corrected or be replaced by a starter that has the proper protection and will open and stop motor when the conveyor gets jammed or overloaded.—D.S.V.

LOW INSULATION RESISTANCE

QUESTION 144. If a motor were checked and one found the resistance of the insulation to be slightly lower than the recommended minimum, what should be done? Should it be rewound? —F.F.

A. TO QUESTION 144. An isolated test value of insulation resistance is not usually indicative of the life expectancy of the insulation. If the motor winding has been exposed to damp atmosphere, the first test of insulation resistance may indicate a safe value. If then the winding is heated to its normal working temperature, the resistance will be found considerably less than the initial test, possibly less than the recommended minimum. After several hours of maintained heat the resistance will be observed to rise gradually to the final temperature which may be well above the allowable minimum. This temperature should be recorded as indicative of the condition of the insulation at the time the test is made.

The insulation resistance at normal working temperature of the winding should be observed periodically, say annually for motors up to 150 hp. and as often as every three months for very large motors. The resistance value so determined plotted against time is considered to show up the condition of the insulation to best advantage. As long as the derived curve is smooth, the insulation may be considered satisfactory even though the last observed value of resistance is below the recommended minimum for a first class job. When the curve shows a decided bend downward, trouble can be considered imminent and isolation and repair of the affecting coils or complete rewind should be considered.

It must be understood that satisfactory insulation resistance as measured from copper to core does not guarantee that the motor winding will not give trouble because there may be defects within the winding itself. Again a motor operating on an ungrounded system may not have its insulation to

ground seriously stressed until one of the phases is forced to ground potential at some point on the system. Vigilance in observing and recording insulation resistance is certainly a commendable practice but satisfactory data observed should not be considered as infallible proof of long life expectancy. —G.I.S.

A. TO QUESTION 144. One test of insulation resistance alone is not sufficient to warrant rewinding a motor. Periodic tests will more truly indicate the condition of the insulation. Insulation resistance varies with temperature, humidity, dirt accumulation, etc. These conditions should be noted on test data sheet.

The motor should be blown out and cleaned before taking the test. If the result is a low reading (one megohm is considered a fairly safe standard), the motor should be baked to determine if moisture is the cause. If the baking improves the insulation resistance it would be well to apply a coat of insulation varnish after the baking. If the motor stays well within its temperature rise limit and takes nameplate amperes on full load, then rewinding should be unnecessary—J.R.

A. TO QUESTION 144. When I have a motor sent into the shop after having tested and found the insulation resistance value low, that is less than one megohm, I have the motor thoroughly cleaned.

In cleaning an a.c. motor we dismantle motor, check bearings and shaft, clean heads of motor and then go to cleaning the stator and rotor.

When cleaning the stator we wash it with hot water and low pressure steam to remove all trace of grease and chemicals. If necessary to remove grease, we sometimes have to wash with No. 9 refined oil then again wash with steam and hot water. The rotor is treated the same way.

Do not allow hot water or steam to play on one place, or coils might be damaged. Play the water and steam all over the coils rapidly; the time will depend on the size and condition of the motor being cleaned. Ten minutes will usually clean a 25 hp. stator and rotor.

After the cleaning has been finished put the stator and rotor in the bake oven and raise temperature to 180 deg. F. and hold for eight hours or until both are thoroughly dried out.

Next remove from oven and dip the stator in black baking varnish while stator is still hot.

Roll the rotor in a varnish pan, deep enough to cover rotor bars with varnish and keep shaft clean.

The stator and rotor are now put back in the oven and baked 18 hrs.

Care *prevents* Wear

● It's not unusual to find Johnson Electric Motor Bearings delivering excellent service for ten, fifteen and even twenty years. When they are properly installed, kept in line and properly lubricated they often outlast the motor. Right now when they are so hard to replace, it will pay you to give them the best of care. If replacement is necessary, order well in advance to prevent a breakdown of your vital equipment. Johnson Bronze Company, 490 S. Mill Street, New Castle, Pennsylvania.



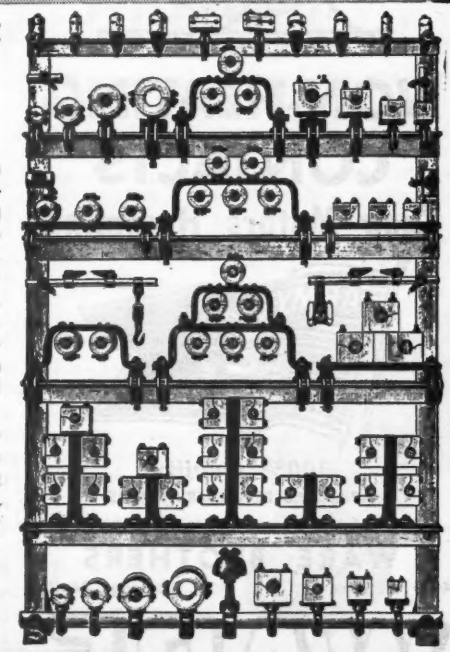
"EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION

••• A COMPLETE *line of* SUSPENSION DEVICES!

● For safer, more economical suspension of electrical installations specify EFFICIENCY Devices! Designed to fill a long recognized need, EFFICIENCY Suspension Devices are available for attaching wires, cables, conduit, and pipe to all construction forms and surfaces; structural steel, concrete, brick, hollow tile, or wood . . . without drilling holes! This important advantage makes possible savings not only in time and labor but also in cost of electrical installations.

The illustration at the right shows a number of EFFICIENCY Devices mounted as they would be in actual installations. Note that these fittings clamp solidly to columns, girders, angles, pipe or messengers, safely and securely.

Write today for your copy of EFFICIENCY Catalog 38A . . . contains complete construction and application data on all EFFICIENCY Devices.



Efficiency
ELECTRIC AND MANUFACTURING CO.
MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT WIRE AND CABLE SUSPENSION

Protection Safety with COOL FUSES



WARE HI-LAG



NON-HEATING CONTACTS

Keep Motors Humming

ARMY E NAVY

100% Quality

APPROVED BY UNDERWRITERS

Mfgr's. Agents Territory Open

WARE BROTHERS

4410 W. Lake St. Chicago 24, Ill.

WARE Renewable HI-LAG FUSES

at a temperature of 212 deg. F.

After the 18 hr. baking period has expired, the stator and rotor are removed from the oven and allowed to cool to 72 deg. F. or room temperature.

When they have reached room temperature or 72 deg. F., they are ready to be checked for insulation resistance (not sooner). We use a Megger.

As a rule, after a motor has been cleaned and varnished as above, the insulation resistance test will usually show one megohm or more. That has been my experience.

The above method is used on motors that operate on voltages of 440 and lower. On 2,300 volt motors, after we have tested our insulation resistance value we then make a dielectric test for insulation breakdown before the machine is put back in service, if the insulation resistance test proved O.K. (Five megohms or above on 2,300 volt motors in our plant).

The Standard Handbook for Electrical Engineers furnishes a wealth of material on this subject.—G.W.L.

A. TO QUESTION 144. If the insulation readings of a motor are only slightly under the recommendations then the following steps should be taken.

First, take a reading in the proper manner. Disconnect the terminals at the motor otherwise the test will include the insulation of the circuit wiring, switches, etc. Check the condition of the terminal leads from the windings. Frayed and cracked insulation on the leads will give a low reading.

Secondly, bake the motor for 24 hours and then take a reading. If the reading comes up closer to standard, continue baking until the reading is stationary. This stationary reading will usually equal or surpass the minimum standard.

If continued baking fails to raise the reading then connect the motor and run it without a load. Hook-up an ammeter in the circuit and place a thermometer on the frame of the motor. Consult the nameplate and observe that the amperage stays within safe limits and is constant for two hours. See that the temperature stays within safe limits. At the end of this time connect the load and observe the amperage and temperature for at least eight hours.

If the amperage and temperature raise are within nameplate specifications then it is safe to assume that the motor is in good condition. Continue to check amperage and temperature hourly for several days. Use a thermometer to check temperature. Never depend upon the "feel" of the motor.—G.B.

TO CONVERT MOTOR TO A GENERATOR

QUESTION 145. We have a 30 hp. 230 volt d.c. compound wound motor, amperes 110, rpm. 1100. I would like to convert this motor over to a generator. Can a reader suggest the necessary changes which will do this?—R.E.P.

A. TO QUESTION 145. To convert a compound motor to a generator, reverse the connections to the series and commutating fields, then drive it in the same direction it ran as a motor.

To get the best results, run it at about 15 percent higher speed than it ran as a motor. This will give you a range of voltage adjustment as the output voltage can be held at 230 volts with any load. This can be done with a field rheostat in the shunt field circuit. Otherwise the maximum voltage output will be about 230 at no load, and will drop as the load is increased.—C.A.M.

A. TO QUESTION 145. Assuming that the fields are all properly connected up, use the same rotation but interchange the series field connections. In other words, reverse the series field. Or perhaps a shunt generator is more desirable, if so, just short out the series field.—E.J.K.

A. TO QUESTION 145. A compound wound motor should operate satisfactory as a generator. The shunt field should have a rheostat inserted in its circuit for regulating the voltage. Of course, an automatic voltage regulator may be used if desired. For best results the connections to the series winding should be reversed, as current is reversed when the machine is operating as a generator. Reversing the series winding will give a more flat range of the output voltage with a change of load.—L.R.B.

A. TO QUESTION 145. The machine has probably been run as a cumulative compound motor and it is desired to operate as a cumulative compound generator. Since, for the same external polarity and the same direction of rotation, the current in the armature circuit as a motor is opposite to that as a generator, it will be necessary to reverse the series field connection. Then, all that is necessary is to connect to a prime mover and start up.

A few experiments may be neces-

sary, especially if the machine has stood idle for some time, or the previous connections and direction of rotation is not known.

A field rheostat will be necessary for regulating the voltage. With the resistance all cut out, and the shunt field connected either across the armature (short shunt) or across the armature and series field (long shunt), bring the machine up to speed. If the generator fails to build up its voltage, as indicated by a voltmeter connected to the generator terminals, try reversing either the shunt field connections or the direction of rotation. Sometimes a little over-speed or extra pressure on the brushes may be necessary. If the generated voltage still fails to build up, and the shunt field is in good condition, it may be necessary to restore the residual magnetism to the field poles by connecting the shunt field to a battery for a few minutes. After this is done, experiment again with the field connections and direction of rotation until a combination is found that will make the voltage rise when the generator is brought up to speed without load.

Then apply a load and watch the terminal voltage. If voltage drops rapidly, the series field may be opposing the shunt field. This can be proved by short-circuiting the series field while the generator is loaded. If voltage rises upon short-circuiting the series field, the series field connections should be reversed. If voltage drops upon short-circuit, the series field is properly connected.

If the machine has no commutating poles, the brushes may need to be shifted forward (in the direction of rotation) from the geometrical neutral. The point of minimum brush sparking can be found by observation.

If the generator has commutating poles, the brushes should be left in the mechanical or geometrical neutral. The polarity of each commutating pole should be just the same as the main pole next forward in the direction of rotation.—L.E.B.

HIGH-VOLTAGE TESTING

QUESTION 146. I would like to hear how other readers improvise testing equipment for use in running a double-the-voltage-plus-one thousand test on lead covered cables. When energizing currents are too great for a continuously adjustable autotransformer then a water rheostat is indicated. I find it practically impossible to get smooth



—a new FULLY ADJUSTABLE Threader for pipe up to ¾" and bolts up to 1". *Write for Catalog 44*

BEAVER PIPE TOOLS INC.

942 DEEN AVENUE WARREN, OHIO

Tops in Protection

The spectacular production job America is doing is one of the miracles of all time.



TRICO *"Powder-Packed"* Renewable Fuses and KLIPLOK CLAMPS are contributing a full measure in the drive for producing much more—faster—better—and at LESS COST. The choice of discriminating engineers everywhere because they deliver top-notch efficiency and dependability. You get THREE TIMES THE SERVICE and protect production schedules against unnecessary stoppages.

TRICO KLIPLOKS

Exert a vise-like PRESSURE contact between fuses and clips. The destroying temperatures that cause fuse clips to lose their tension—fuses to become destroyed and blow prematurely—delays and costly repairs, etc. disappear the moment TRICO KLIPLOKS are applied. There's a size for every type of clip.



TRY THIS

FAMOUS TRICO COMBINATION

WRITE FOR BULLETINS 1 and 6

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

When You Buy a
BENDER
. . . Check to Make Sure You Get *These* Features



EASY TO GET TO THE JOB
Lightweight and portable, one man can easily carry or roll any Blackhawk Pipe Bender right to the job. Saves time and manpower. Bend rigid conduit and pipe up to 4".



WORK AT ALL ANGLES
Compact hydraulic Porto-Power ram of Blackhawk Pipe Bender works in all directions. Unique design. Avoids kinking. Power eliminates need for heating.



WORK OVERHEAD
All-directional operation and light weight permits work on existing pipe runs.



SIGHT FROM ANY ANGLE
Remote control permits operator to stand in any position necessary to give him full view of job. Blackhawk Benders save need for elbows and couplings and otherwise necessary cutting and threading.

DETACHABLE POWER UNIT *for Extra Utility*
This unit (the heart of the bender) with special available Porto-Power attachments, can be adapted for pulling drive pulleys, lifting heavy equipment into place and doing scores of other trouble jobs.



BLACKHAWK MFG. COMPANY
Dept. P2094, Milwaukee, Wis.
Send full information on your pipe benders.
Name.....
Company.....
Address.....
City..... State.....

BLACKHAWK
Porto-Power
PIPE BENDERS

control for the full range. Unless I add large amounts of salt, I cannot reach the peak voltage; then as soon as the movable electrode contacts the water I get a tremendous increase in voltage. How can I start the test at practically zero voltage and gradually increase until maximum test value is reached?—E.J.K.

A. TO QUESTION 146. As I understand E.J.K., he has a single-phase high-voltage transformer, whose high side is connected to the cable to be tested and whose low side, instead of being energized by a continuously adjustable auto-transformer, is connected to the line in series with a water rheostat. The trouble with this arrangement is that the resistance of the rheostat must be infinity to bring the high test voltage down to zero. A resistor can be successfully used instead of an auto-transformer only if its ends are connected *across* the line, with one end and a movable tap connected to the transformer leads.

The test conditions can be improved, but not remedied, in two ways:

1. Connect an additional resistor (cast iron, wire wound, etc.) in series with the water rheostat;
2. Use the water rheostat first with tap water, and decrease the resistance *during* the test by adding salt.

—L.F.R.

A. TO QUESTION 146. Use a water potentiometer. That means you bring both high voltage leads into the water and connect one lead at one side of the potentiometer and the other lead to the movable electrode. For minimum voltage hold both leads of the cable together. By moving the slide toward the other terminal you will get any voltage you want between zero and full voltage.

If you want a dry system, you can use high voltage rectified d.c. Give it enough time to get fully charged. Caution: after you are through you will have to discharge the cable, to prevent an accident, by connecting a resistance across the cable.—H.S.

Can you ANSWER these QUESTIONS

QUESTION P6—We replaced a 10 hp., 600/1200 rpm., adjustable speed compound wound d.c. motor with a 15 hp., 700 rpm. shunt wound interpole motor on a paper slitter. This motor was used with a field rheostat to give a speed range of 2.1. The field current at 700 rpm. was .9 amperes and at 1400 rpm. was .35 amps. Average load on this machine is 50 amperes. Under

midget
TRIPLOC



compact, heavy duty plugs and receptacles

● Midget Triploc plugs and receptacles are ideal for use with a great variety of portable electrical equipment where operating conditions are severe. Interchangeable 2, 3, or 4 pole contact units permit many different types of assembled combinations. The protected female contacts may be assembled in either plug shell or receptacle housing for protection in line side of circuit. Automatic bayonet lock is simple and effective; polarity is maintained and correct insertion of plug assured by unequal spacing of contacts. Ground protection is provided. Write for General Catalog with complete listings of all types. Rating 10A, 250V., 15A, 125V.

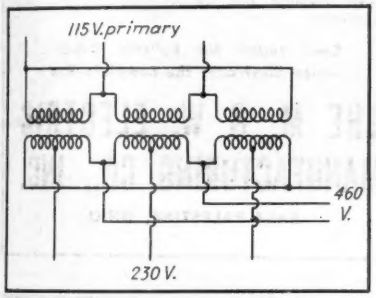
THE PYLE-NATIONAL COMPANY
1344 N. Kostner Avenue, Chicago 51, Illinois

load with motor at 1400 rpm. the line amperes fluctuated widely from about 5 amperes to 100 amps. and speed of slitter varied accordingly but not in proportion to line amperes. The field current remained steady at this speed. The compound wound motor always handled this load without any variations in speed or amperes. While I realize this is an excessive speed range for a constant speed motor, what is the reason for the motor acting like this?—H.R.S.

QUESTION Q6 — From an m-g set supplying 125 volts, 25 cycles, 230 amperes we connected a bank of three 10 kva. transformers. The primary side was connected closed delta, so was the secondary, to give 460 volts. We also wanted 230 volts from the same bank so that our tester would have available—

125 volts three phase 25 cycle
230 volts three phase 25 cycle
460 volts three phase 25 cycle

However when a load of twenty amperes was applied on our 230 volt line (single



phase) the voltage was pulled down to 90 volts. We checked all connections to conform with rating plate. Above is a sketch of hook-up. What caused such a voltage drop?—W. H. L.

QUESTION R6 — I was once called on a boat to find out what the trouble was with a compound wound dynamo. This dynamo was running all right until it was stopped to make repairs on its prime mover. When the dynamo was again started up the voltage would build up all right, but when load was applied the voltage would collapse on the dynamo.

The first thing I did was to reverse the series field, this did no good, so I connected it back the way it was at first, then reversed the shunt field. When this was done the voltage would not build up at all. So I connected it back the way it was in the beginning. Then I passed current from another machine through the shunt field coils. This didn't remedy it either. Next I shifted the brushes. This had the effect of raising and lowering the voltage. By that time the boat was ready to sail and I had to leave the job without finding the trouble.

I would like to know if any of the readers of *Electrical Contracting* have had similar trouble and if so how they remedied it.—H.J.A.

PLEASE SEND IN YOUR ANSWERS BY OCTOBER 1



E·M·T CONNECTIONS IN A FEW SECONDS!
With B. M. Fittings



TWO QUICK SQUEEZES give you Finer, Faster Conduit Connections. B-M Fittings do away with the twisting, turning and tightening of nuts and save you valuable time and materials. Then too, they are stronger, neater and much easier to work with in tight places. Start using B-M Fittings today. Have more satisfied customers—more profits from each job!

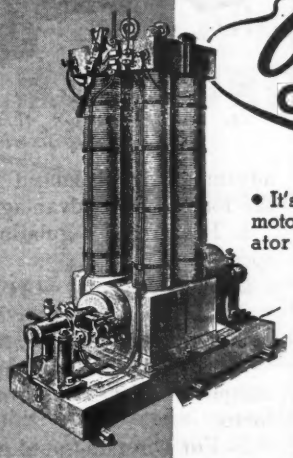
(All B-M Fittings carry the Underwriters Seal of Approval)

DISTRIBUTED BY

The M. B. Austin Co., Chicago, Ill.
Clayton Mark & Co., Evanston, Ill.
Clifton Conduit Co., Jersey Cy., N. J.
Gen. Electric Co., Bridgeport, Conn.
The Steelduct Co., Youngstown, Ohio
Enameled Metals, Pittsburgh, Penn.
National Enameling & Mfg. Co., Pittsburgh, Pa.
Triangle Conduit & Cable Co., New Brunswick, N. J.

Prompt Deliveries on Properly Rated Orders

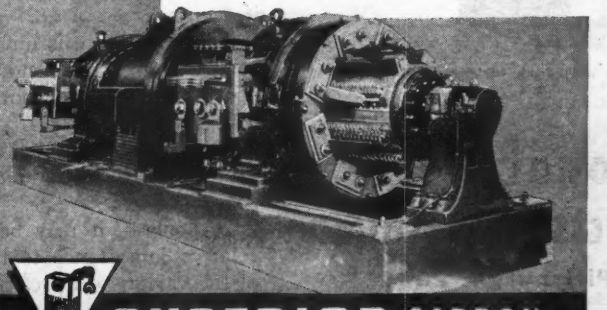
BRIEGEL METHOD TOOL CO. • Galva, Ill.



60 Years OF PROGRESS

• It's a far cry from Edison's bi-polar motor of 1884 to the big 3-unit generator shown below, equipped with *Superior* Carbon Brushes to meet the government's demands for long life, low friction and low temperature rise. The *Superior* Research Department waits to analyze your needs likewise.

SUPERIOR CARBON PRODUCTS, INC.
9113 George Ave. Cleveland 5, O.



"Since 1919" SUPERIOR CARBON BRUSHES



DURING these critical times we found that our best service to our country consisted in doing well the job for which we were best qualified. That meant turning out, in great quantity, wires, cables, conduits, connectors and other items of the highest quality, to serve directly and indirectly, every branch of the armed forces. With victory and peace, we can again render old and new customers the service for which National Electric has always been noted.

★ ★ ★ NE ★ ★ ★

National Electric Products Corporation

Pittsburgh, Pa.

Quality Electrical Products Since 1905

Selection & Application of Wound Rotor Motors

[FROM PAGE 83]

wound-rotor motor. To summarize, the wound-rotor motor gives the following advantages:

1. Low starting current with high starting torque.
2. Possibility of adjustable speed operation.
3. Simple and rugged design.
4. Relatively low cost for adjustable speed drive.
5. Small spaee requirements for motor itself.
6. High efficiency at full speed.
7. Applicability to plugging or dynamic braking.

Since it is not possible to obtain all the above advantages without sacrificing some good characteristics, the



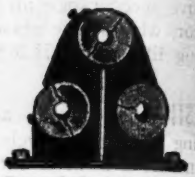
Fig. 9 Construction of a two-speed motor with six rings.

advantages are balanced somewhat by the following disadvantages:

1. Poor speed regulation at reduced speeds.
2. Poor efficiency at reduced speeds.
3. Limited number of speed control points with standard controllers.
4. Control is bulky and relatively complicated for an alternating current motor.
5. For constant speed operation, the cost of the motor and its control is high compared to a squirrel cage motor and its control.
6. Maintenance is unfavorable when compared to a cage motor, because of brushes, rings and more complicated control.
7. Slip rings and brushes subject to protection from dirt and isolation of sparks.

In general, it may be said that the relative importance to the application of the various features tabulated above will determine the practicability of considering the use of a wound-rotor induction motor.

SIMPLICITY PLUS!
New NON-INDUCTIVE CABLE RACK
for INDUSTRIAL PLANT WIRING



Type D-F 3-Conductor Cable Rack. New Non-Inductive Design. Racks available for Cable sizes from 5/16" to 2⅝".

● Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction . . . installation of cables made qaick and easy through the use of split bushings.

Send today for Bulletin C-S-51 which illustrates the complete line

THE M. & W. ELECTRIC MANUFACTURING CO., INC.

EAST PALESTINE, OHIO

AVOID FLIMSY FASTENINGS
In Masonry & Concrete
WITH
PAINE ANCHORS
LEAD EXPANSION TYPE



The LASTING FASTENING

★ You simply place in hole, tap with setting tool and tighten.
★ Save time and effort. Assure a permanent workmanlike job.
★ Precision threaded, rust and vibration resistant 900 available in 9 different diameters 6-32 to ½". 910 in ¼", ⅜", ½" diams. in standard lengths. Available on Low Priority.

Ask your Supplier or Write for Catalog

THE PAINE CO.
2961 Carroll Ave. Chicago 12, Ill.
Offices in Principal Cities

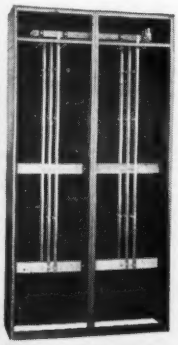
PAINE FASTENING and HANGING DEVICES

CENTRALIZED CONTROL

Allen-Bradley Multi-Unit Control Panels locate all controls in one spot. This results in a more attractive installation. Periodic inspections can be made at one spot. Also, unauthorized persons cannot so readily tamper with the control, as where the unit starters are distributed throughout the plant. Usable space may be saved near important machines.



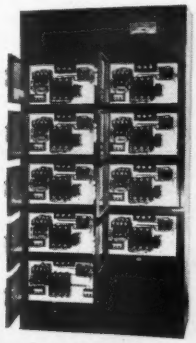
Streamline YOUR PLANT with Allen-Bradley MULTI-UNIT CONTROL



Rear view showing busbars feeding Allen-Bradley Multi-Unit Controls.

Many plant layouts can be streamlined by grouping the motor controls in a centralized location . . . with the pilot control wires running to push buttons on individual machines. For such centralization of control, Allen-Bradley Multi-Unit Control is the answer. Each motor starter is a unit in a sectional cabinet that can be assembled to form a streamlined control center. It will pay you to investigate the many advantages of Allen-Bradley Multi-Unit Control. Write for more information.

Allen-Bradley Company, 1316 S. Second St., Milwaukee 4, Wis.



Front view showing accessibility of Allen-Bradley Multi-Unit Controls.

ALLEN-BRADLEY

MULTI-UNIT CONTROL

QUALITY



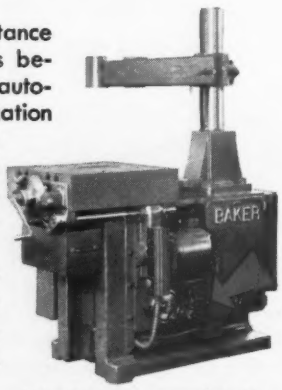
Right and Wrong Ways to use limit switches. A handy guide for designers of motorized machines.

Do you use enough LIMIT SWITCHES?

Here is a 24-page data book on limit switches . . . and how to apply them

Limit switches are growing in importance to machinery designers and builders because of the demand for completely automatic sequence operation. The application requirements are so diversified that the Allen-Bradley line lists several hundred different types . . . each one adapted to meet the needs of a particular machine or duty cycle.

The whole story of Allen-Bradley limit switches, and how to select and install them, is told in the 24-page data book known as Bulletin 801-802.



Baker Key Seater controlled with A-B Precision Limit Switches

It is a gold mine of information on hundreds of varieties of limit switches. It also contains a special section on "Right" and "Wrong" ways to install limit switches.

Have you considered the possibilities of limit switch control on your machines or equipment?

If not, let one of our specialists check your machines for possible improvements with limit switch control.

Or, send for Bulletin 801-802.



ALLEN-BRADLEY

LIMIT SWITCHES FOR EVERY SERVICE

QUALITY

Wiring For Steel

[FROM PAGE 47]

control operator at the central switch house. On the main control board telemetering and other metering instruments give visual indication of various operating conditions.

Regular steel industry practice is employed in the racking of feeder cables for the auxiliary motors in the plate mill and structural mill. Distribution either goes up into the steel trusses of the building or is run underground.

Lighting levels in the general mill area range from 5 to 10 foot-candles. The general lighting is done from overhead high-bay Millite Westinghouse units, with glass covers at the bottom for ease of maintenance and to prevent deterioration of reflecting surface. In areas where higher illumination level is desirable auxiliary equipment is installed. For example, in the slab conditioning and bloom conditioning part of the mill 3,000-watt, high-intensity mercury lamps are mounted at the roof trusses 59 ft. above the floor and produce illumination of about 32 foot-candles on the working area.

In the maintenance shop where high intensity is required Holophane units in pairs, containing a mercury 400-watt, high-intensity lamp teamed up with a 750-watt incandescent lamp are run in two parallel rows with a single row of incandescent reflectors down the center. This provides about 27 foot-candles on the floor area. Under the balcony 32 foot-candle illumination is obtained from units containing two 100-watt fluorescent tubes for each 64 sq.ft. Mounting height is about 48 ft. in the main area.

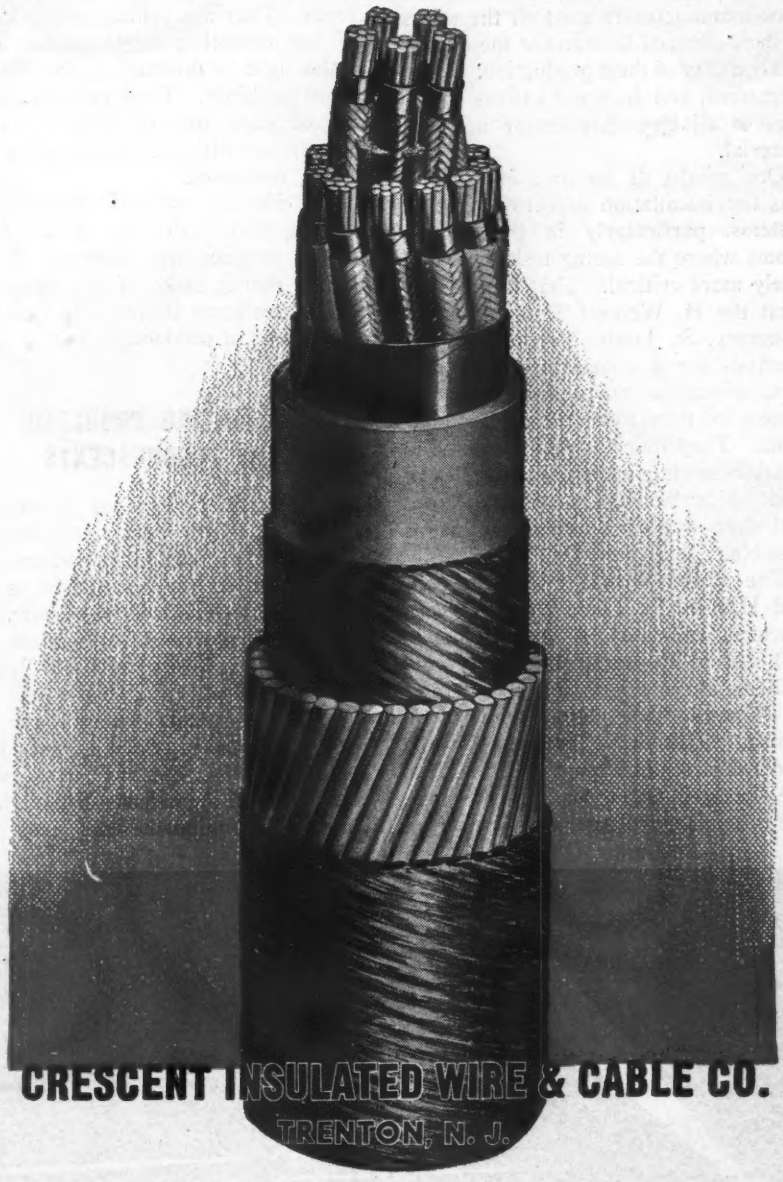
All roadways and property fences are lighted by refractory type luminaires on metal brackets mounted on wood poles at approximately 150-ft. centers. A series system is used with the parkway cables running parallel to the roadway. The railway classification and storage yards, a mile in length, are lighted from six towers, 100 ft. high, made of wood and erected in pairs along the length of the yard. On each of the towers are four 1,000 or 1,500-watt floodlights.

Office lighting in the administration building, the plant dispensary and other auxiliary buildings is fluorescent, using the two lamp industrial type of fixture with two 40-watt white fluorescent lamps. Over the control panels in the switch house inbuilt Holophane lens units are mounted in the ceiling.

RUBBER POWER CABLES • VARNISHED CAMBRIC CABLES • PERMACORD • LEAD-ENCASED AND PARKWAY CABLES • SYNTHOL WIRES • WELDING CABLES • SHIPBOARD CABLES • IMPERIAL NEOPRENE JACKETED PORTABLE CABLES • ARMORED CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • BUILDING WIRE •

CRESCENT

Ability to Manufacture
WIRES and CABLES
is the Result of
OVER FIFTY YEARS EXPERIENCE



CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

CRESCENT
WIRE and CABLE

NEMA

MODERN LIGHTING

MAKING TENTS UNDER COLD CATHODE

Faced with the increased demands of the armed services, the tent and duck manufacturers used all the tricks at their disposal to increase the quality and quantity of their production. Tents, tarpaulins, and duck and canvas coverings of all types are major items of material.

One means of boosting production was the installation of better lighting systems, particularly in the sewing rooms where the seeing tasks are definitely more critical. That is precisely what the H. Wentzel Tent and Duck Company, St. Louis, Mo., did. Their demands for a comparatively trouble free, minimum maintenance lighting system led them to choose cold cathode units. They found it was no picnic to straddle sewing machines and piles of duck with ladders to change lamps and they wanted as little of this as possible.

The system installed by Hornbeck and Hardie, St. Louis electrical contractors, consisted of approximately 400 feet of Federal Line-O-Lite cold cathode fixtures containing two rows of 20 mm., 3,500 degree white Zeon tubing. The units, supplied by the Federal Brilliant Company, St. Louis, are operated on 60 ma. transformers, the secondary voltage and number of transformers depending upon the length of tubing connected to each.

The porcelain enameled reflectors are mounted end-to-end in a continuous line centered over rows of sewing machines. They are ceiling suspended at a 7-foot mounting height so that most of the light is directed at the needles of the machines. The length and location of each row of fixtures varies to conform with the locations of the sewing machines.

An over-all, general illumination, working-plane intensity of 25 foot-candles reduces the intensity of the critical seeing tasks of the operators with a resultant increase in quantity and quality of production.

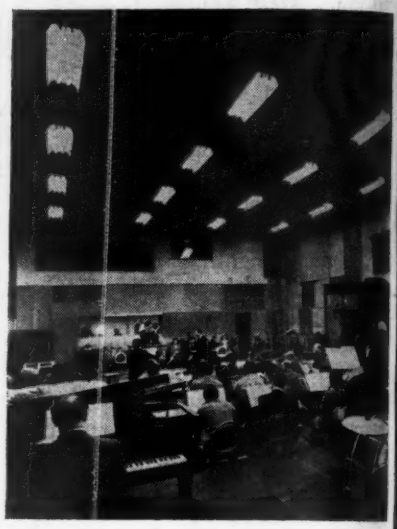


MORE LIGHT—LESS FATIGUE and more production in this sewing room of a tent and duck manufacturer. High-voltage, cold cathode Zeon lighting provides a blanket of 25 foot-candles at sewing machine surfaces.

STUDIO LIGHTING PROBLEMS SOLVED BY FLUORESCENTS

A new installation of fluorescent lighting in a New York studio devoted exclusively to recordings, where any electrical interference would be as objectionable as a fulltime buzz-saw, has ended many months of complaints, according to officials of the World Broadcasting System.

Technical requirements of the recording company, which is owned by Decca Records, Inc., led to a novel installation of the ballasts of the lamps. The ballast equipment from each pair of fixtures was removed, and mounted in ventilated metal boxes above the ceiling's soundproofing and effectively "outside" the room. This mounting not only eliminated heat generated in the ballasts but more importantly removed all trace of the hum that sometimes accompanies operation of a fluorescent installation. Silence is solid gold inside a recording studio.



NOVEL INSTALLATION of fluorescent lighting, with the accessories mounted outside the soundproofing, end heat, spottiness, glare and objectionable shadows in this massive, recording studio.

There are 24 fluorescent lighting fixtures, each with two 100-watt fluorescent lamps. The fixtures are mounted on the 22-foot high ceiling, four abreast in six rows, parallel to the length of the 76-foot studio which is 36 feet wide.

The former lighting system consisted of eleven special incandescent fixtures plus a variety of drop-cord lights with bare, 100-watt incandescent lamps suspended where needed. This installation furnished between four and 12 foot-candles about two feet from the floor with a consumption of 7½ kilowatts. The new system provides better than 35 foot-candles at the same level, while consuming 5½ kilowatts. This amounts to about two watts per square foot at a 22 foot mounting height.

F. J. Cadenas, executive engineer of the lighting division of Sylvania Electric Products Inc., designed the installation with the assistance of Charles Lauda, chief engineer of World Broadcasting.

New

DAY-BRITE DESIGNS NOW AVAILABLE



THE PARKWAY

Direct Ceiling or Suspension Mounting, for four 40-watt lamps. Write for Bulletin F-80.

THE CORONADO

Direct Ceiling or Suspension Mounting, for four 40-watt lamps. Write for Bulletin F-80.

For Work Areas and Administrative Offices

Here are two new Day-Brite Fixtures that answer the call for suspension or direct ceiling mounting in offices, work areas, administrative and engineering offices . . . Maximum illumination is achieved in both designs . . . The PARKWAY is an open-type fixture with reflecting surface of baked SUPER-WHITE enamel for high permanent efficiency. Die-formed, steel ends are finished in baked lustre aluminum enamel. Lamps removable without disturbing ends . . .

The CORONADO is a shielded type unit with ribbed diffuse glass side panels. Reflecting surface and louvers are finished in baked SUPER-WHITE enamel. Steel enclosure frame in baked lustre aluminum enamel. The entire enclosure is held in place by spring suspension tension clips and service chains—easily installed and removed in a few seconds . . . Both types are complete with all necessary fittings, ready for quick installation.

HEAVY-DUTY RLM DAY-LINE INDUSTRIAL FIXTURES

Again available with porcelain enamel reflectors, plus Day-Brite's exclusive "ice-tong" hangers which assure low-cost installation speed.



THE HEAVY-DUTY DAY-LINE Single unit or continuous runs, for two or three 40-watt or two 100-watt lamps. Write for Bulletin F-77.

Get all the facts on the complete Day-Brite line . . . Consult your nearest Day-Brite Engineering Representative . . . Write for Bulletins.

DAY-BRITE

The Sign of Quality
Look for the Label

Day Brite
LIGHTING FIXTURES

79

DAY-BRITE LIGHTING, INC.
5435 Bulwer Avenue • St. Louis 7, Missouri

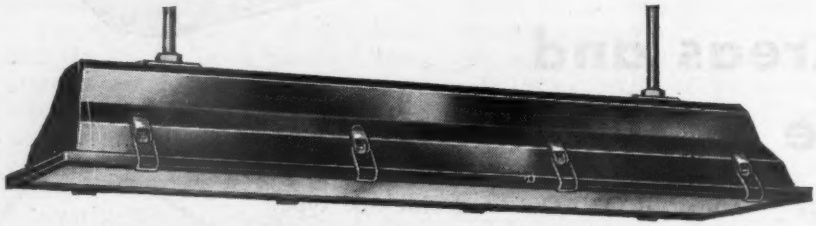
Nationally distributed through all leading electrical supply houses

EQUIP YOUR PLANT WITH *Skilled Lighting* NOW!



In the light of wartime experience, progressive manufacturers have learned the vital importance of SKILLED LIGHTING to speed output and reduce accident. For better production *today* and better products *in peace time,* they are installing Wheeler-engineered fluorescent fixtures *now.*

This is especially true since Wheeler is back in production of the *all-steel unit* – highly-developed product of wartime research plus 63 years of lighting experience. Open-End *all steel* Fluorescent units are available for two 40-watt, three 40-watt and two 100-watt lamps. Units have a broad metal wiring channel, with easily-accessible, enclosed ballast. Can be mounted from chain or conduit, in individual or continuous runs. Messenger Cable, Rod, or Close-to-Ceiling Suspension fittings. Overall fixture efficiency of two 40-watt unit 80%, three 40-watt unit 74% and two 100-watt unit 71%.



ALL-STEEL DUST-TIGHT Fluorescent Fixture for Class II "Group G & F", and Class III and IV Hazardous Locations will prove as efficient and economical in peace time as it is in meeting wartime demands for SKILLED LIGHTING, where lamps, sockets and reflecting surfaces must be protected from dusts and vapors. Available for two or three 48-inch, 40-watt lamps.

These dependable units can be supplied with Double-Thick Plain Clear Glass, Water White Plate Glass or Tempered, Clear Safety Plate Glass, mounted in the hinged dust-tight cover.

• • •

These are but two examples of the high-efficiency light engineering – SKILLED LIGHTING – which Wheeler has developed to give maximum visual aid to workers. Write for full details on the complete line of fluorescent and incandescent fixtures. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass. .... New York, N. Y. Representatives in principal cities.**

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

"Eye-comfort of musicians, both vocalists and instrumentalists, has been greatly improved with the non-glare, virtually non-shadow lighting we now enjoy," said Mr. Lauda. "We used to get a lot of complaints and for a while we thought they might be credited to the artistic temperament of most of our guests, but our new lighting shows that the criticism was justified.

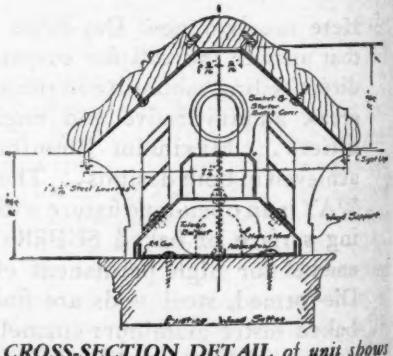
"When you stop to think that we have to control our temperature and humidity from day to day and from morning to afternoon, you'll see that heat is also an important matter for us. The cooler light of fluorescent lamps, and the mounting of the ballasts outside the studio walls, furnished complete solution."

Officials of Decca, including Jack Kapp, president, are enthusiastic about the fluorescent lighting installation. Mr. Kapp gave a two-word opinion when he first inspected the new system, according to an associate who was with him at the time. "Wonderful, wonderful," he said.

LOCAL LIGHTING FOR READING IN A WAITING ROOM

Local fluorescent lighting installed atop existing wood settees now provides an illumination level for comfortable reading in the main waiting room of Union Station, Washington, D. C.

Since the average illumination provided by the general lighting measured



***CROSS-SECTION DETAIL** of unit shows mountings of ballasts, lamps, louvers and wiring channels beneath the inverted wood mouldings.*

approximately one foot-candle, local lighting appeared as the best immediate solution to improved reading comfort.

The partition between opposing seats provides a logical location for the local lighting units. These consist of a continuous inverted wooden molding, the inside of which is lined with baked white-enamel metal which serves as a reflector for the white fluorescent lamps placed end to end. Each settee length employs four 40-watt and two



As Near as Your Phone

The Assistance of Corning Lighting Representatives for the Solution of your Illuminating Glassware Problems

From Boston to Los Angeles . . . Toronto to Dallas . . . wherever you are located . . . there is a CORNING Lighting Representative close at hand. Phone or write him if you have a lighting glassware problem.

Back of him is all of CORNING's "know-how" in engineered lighting applications . . . the experience acquired in prominent installations where CORNING Glassware has increased the efficiency of workers in industry and commerce.

Send for a copy of CORNING Lighting Data Catalog with complete information on CORNING *Flur-o-guide** Lenses and Panels and illustrating typical installations. Write Lighting Sales Dept., EC-9, CORNING GLASS WORKS, Corning, N. Y.

*Flur-o-guides . . . Lens and Panels that are engineered to guide fluorescent light to the areas where it's needed, without eye fatigue.

"CORNING" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.

Atlanta—J. P. Pardiny
491 Terrace Ave. NE
Atlanta, Georgia
Tel.—DE-4094

Boston—G. S. Fobes
Room No. 515
89 Broad Street
Boston 10, Mass.
Tel.—Hubbard 1866

Chicago—E. G. Koehler
Corning Glass Works
Merchandise Mart
Chicago 54, Illinois
Tel.—Delaware 6600

Cleveland—P. C. Saxton
20913 Morewood Parkway
Cleveland 16, Ohio
Tel.—Edison 0918

Dallas—J. F. Echternach
619 N. Lancaster Avenue
Dallas 8, Texas
Tel.—9-5364

Los Angeles—M. G. van Auken
656 S. Los Angeles St.
Room No. 601
Los Angeles 14, Calif.
Tel.—Vandike 0514

New York City—C. L. Ellis
F. A. Filla (export)
Corning Glass Works
718 Fifth Avenue
New York 19, New York
Tel.—Circle 6-8224

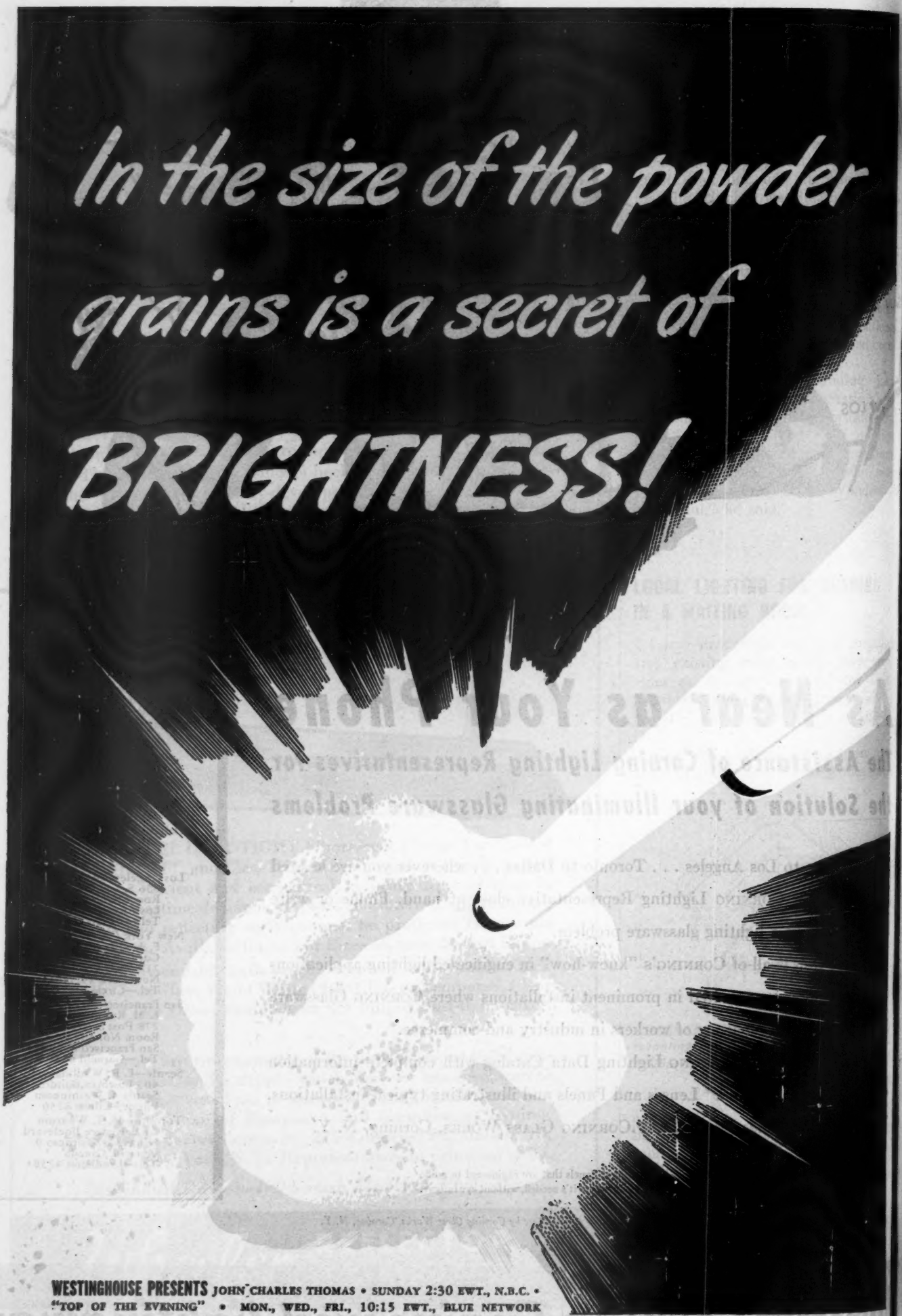
San Francisco—S. A. Baker
L. M. Ryerson
278 Post Street
Room No. 404
San Francisco 8, Calif.
Tel.—Garfield 6150-6151

Seattle—E. R. Wadlington
403 Lowman Building
Seattle 4, Washington
Phone—Elliott 8236

Toronto—H. T. Wharton
21 Belvedere Boulevard
Kingsway, Toronto 9
Ontario, Canada
Tel.—Lyndhurst 4238

CORNING means research in Glass

Corning Engineered Lightingware



WESTINGHOUSE PRESENTS JOHN CHARLES THOMAS • SUNDAY 2:30 EWT., N.B.C. •
"TOP OF THE EVENING" • MON., WED., FRI., 10:15 EWT., BLUE NETWORK



Phosphor powder particles, like human beings, are of infinite variety. Some are fat, some lean. Some are dull . . . and some are *bright!*

Determining the *size* of particle that has the most sparkle has proved one of the most exciting of Westinghouse research problems.

Out of thousands of batches tested, one size has consistently shown the highest degree of fluorescence. This discovery has resulted in the development of phosphor powders with the greatest life and sparkle.

These powders are now used in all Westinghouse fluorescent lamps. That's why the Westinghouse Mazda fluorescent lamp of today delivers bright, high efficiency light wherever it is installed. And that's why it pays to recommend Westinghouse!

While much of our fluorescent production is earmarked for war industry, we are continuing as far as possible to supply fluorescent lamps for essential civilian use. Westinghouse Electric & Manufacturing Co., Bloomfield, New Jersey.

HELP SHORTEN THE WAR . . . BUY MORE BONDS THAN BEFORE!

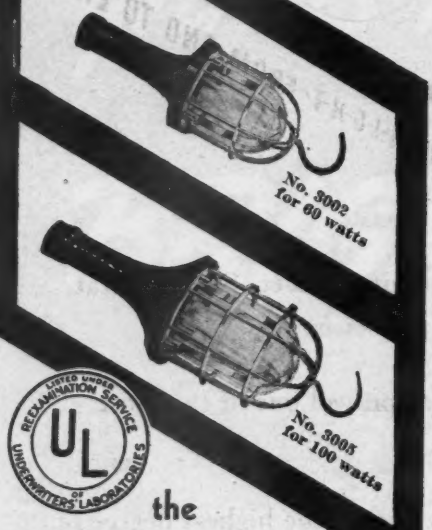
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

MAZDA LAMPS FOR SEE-ABILITY

Safeguard

• LIFE
• PROPERTY
with McGILL
Vaporproof Safety
Guards



the
Guard with the
Seal-Tight Globes

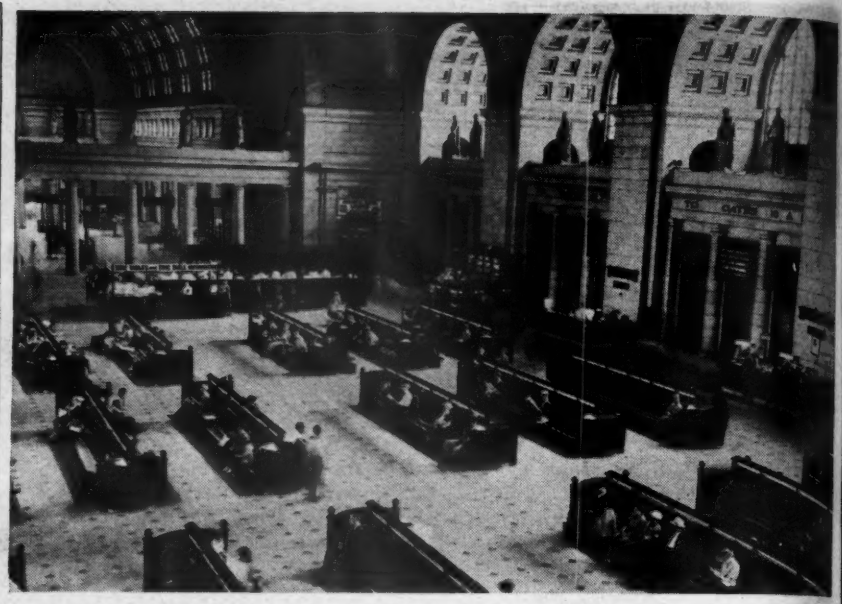
Where there is a possibility of fire, or other disaster from a spark, exposed flame, heat or breaking of bulbs, then McGILL Vaporproof Lamp Guards should be used on all portable or extension lights. The tight-sealing globe and heavy cage, with air-tight seal in handle opening, eliminate these hazards at every spot where this guard is used. These Vaporproof guards are designed to stand up under roughest use and abuse.

These guards also protect the light bulb and prevent breakage when used around machines where water and oil might splash on the bulb. Guards also are grounded—an additional safety feature.

ASK FOR LITERATURE

McGILL MANUFACTURING CO., INC.
Electrical Division
Valparaiso, Indiana

MCGILL



CONTINUOUS ROW FLUORESCENT lighting atop the partition of the wood settees permits comfortable reading under local light.

30-watt lamps. Removable louver guards serve both to prevent tampering and to shield the lamps from direct view by an observer in the opposite settee. After 112 hours of operation, 18 foot-candles was measured on a plane in reading position. The accompanying sketch shows details of construction.

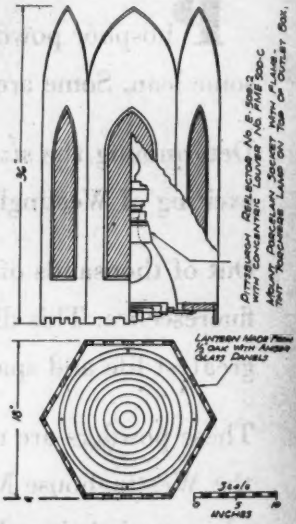
Equipment was designed jointly by the Baltimore and Ohio Railroad Electrical Department and Consolidated Gas Electric Light and Power Company of Baltimore.

CHURCH ILLUMINATION

For an adequate level of illumination with the quality of comfort to create an atmosphere conducive to worship and designed to harmonize with the Gothic architecture, a lantern type fixture installation was made at the First Baptist Church, Waynesburg, Pa.



LANTERN TYPE FIXTURES of Gothic design provide a soft, comfortable quality of light.



CONSTRUCTION FEATURES of the lantern which uses 500-watt IF lamps are shown in this detail.

The church auditorium is 51 feet long by 36 feet wide, with a ceiling height of 28 feet at the center, sloping to 16 feet at the sides. The interior is Gothic with plaster walls and ceiling painted in two tones of flat cream with a stenciled border. The furnishings are constructed of oak with a medium dark finish.

Originally there were four commercial fixtures in this almost square auditorium, and in order to make the area appear longer, six outlets were installed. Recognizing that the lighting of a Gothic church should be mostly "down" lighting, with the ceiling illumination subdued to add to the apparent height, hexagonal lanterns to be made from oak were designed.

The lanterns for the main auditorium are 36 inches high and 18 inches in

NEW

"MITCHELITE"

ALL-STEEL

INDUSTRIAL FLUORESCENT FIXTURES

Engineered for

Rugged Durability

★

Greater Mounting Flexibility

★

Easier Lower-Cost Maintenance

★

Unexcelled Lighting Performance

9 STAND-OUT FEATURES

1. RIGID ALL-STEEL REFLECTORS AND WIRE-WAYS FOR LONG SERVICE
2. OPEN-END AND CLOSED-END TYPES IN 2-40, 3-40 AND 2-100 WATT MODELS
3. CHOICE OF BAKED ENAMEL OR PORCELAIN ENAMEL FINISH
4. AIRCRAFT-TYPE "INSTANT-LATCH" —QUICKLY RELEASES REFLECTOR
5. EASILY JOINED END-TO-END FOR CONTINUOUS ROW LIGHTING
6. ACCESSORIES FOR EASIER, QUICKER MOUNTING OR HANGING
7. NEW, PERFECTED "INSTANT-START" AVAILABLE ON 2-40 WATT MODELS
8. U.L. AND E.T.L. APPROVED THROUGHOUT
9. UNEXCELLED LIGHTING PERFORMANCE —MEETS E.T.L. REQUIREMENTS



PRIORITY: AA-5 for new lighting projects. AA-2 under MRO.

MITCHELL FLUORESCENT

Get full details from your MITCHELL DISTRIBUTOR or write for Catalog No. 281.

MITCHELL *Manufacturing Co.*

2525 N. CLYBOURN • CHICAGO 14, ILLINOIS

Low Priced
PERMAFLECTOR
200 WATT
FLOODLIGHT



ST-200
For
200-WATT
INCANDESCENT

GIVES YOU...

PEAK LIGHTING
at new low cost!

- Projects a full pattern of light on an area of 2500 sq. ft., at a distance of 50 ft.
- Incorporates features found only in larger, higher-priced floodlights • rugged in construction • highly resistant to shock and vibration • weatherproof and corrosion-resistant • equipped with famous silver-mirrored glass Permaflector • steel protective housing • heat-resisting lens, (easily removable for maintenance.)
- Height, 12½"; length, 11¼"; lens, 8⅜" in diameter. Floodlight is easily, quickly positioned to direct the light where wanted—250° swing vertically, 360° horizontally. For shovels, cranes, tractors, or mounting on posts or buildings. Low in cost. Inquire of your jobber or write direct for folder.

PITTSBURGH REFLECTOR CO
OLIVER BLDG., PITTSBURGH, PA.

ILLUMINATING ENGINEERS • DESIGNERS • MANUFACTURERS OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

diameter, with amber glass panels. Each contains a Pittsburgh Reflector Company reflector with a concentric louver and a 500-watt lamp. The lantern in the sanctuary is of the same proportions but smaller, and contains a reflector with a concentric louver and a 300-watt lamp.

The interior of the lantern is illuminated with a 25-watt, flame-tint, torchiere-shaped lamp which casts a faint, mellow glow on the ceiling.

The units in the auditorium are mounted on 18- by 17-ft. centers at a height of 16 feet from the floor. The average illumination after the system was in use seven months was 6.1 foot-candles provided by 1.64 watts per square foot.

COLD CATHODE LIGHTS INDUSTRIAL AREA

When the Jackes-Evans Company, St. Louis, built a new addition to their plant, the management was cognizant of the need for good lighting. Reviewing available light sources for a choice of a system that would best fit the application at hand, they chose cold cathode fluorescent. Prime reasons for the decision were the long life of the cold cathode tube with the resultant low maintenance cost. Since the area involved was to be used for the operation of various types of machines, the reduction of ladder shifting for tube replacement to an absolute minimum was highly desirable.

The lighting system, as installed by Cole Electric Company, St. Louis, consists of three rows of cold cathode fluorescent fixtures supplied by the Federal Brilliant Company, St. Louis. Each row is 330 feet long, composed of groups of three 6-foot fixtures mounted end to end. Each 6-foot unit contains four 3,500 degree white, 20 mm. tubes operating on 60 milliampere transformers with a 110-volt primary and 7,500 volt-secondary. Each group of three fixtures is served by two transformers, six 6-foot tubes (36 lineal feet total) per transformer.

The units are suspended, at a 16-ft. mounting height, from the stringers which tie-in the steel truss chords. Spacing between rows is 20 feet. The new lighting provides an intensity of 18 to 22 foot-candles on the working plane; has a total output of 720,000 lumens and a current consumption of 19,200 watts.

INSPECTION OF CHROMIUM-PLATED BALL BEARINGS

One of the lighting problems confronting engineers in a Chicago war plant was to provide lighting for the inspection of chromium-plated ball bearings so that defects in the metal and in the plating could be detected with a minimum of eye fatigue.

The ball bearings range in size from ½ inch to 1½ inch diameter. Direct light resulted in an abnormal degree of reflected glare and greatly restricted the area of surface in which defects could be seen. Indirect lighting relieved eye fatigue caused by reflected glare and almost doubled the area in which flaws could be detected.

[Continued on page 170]

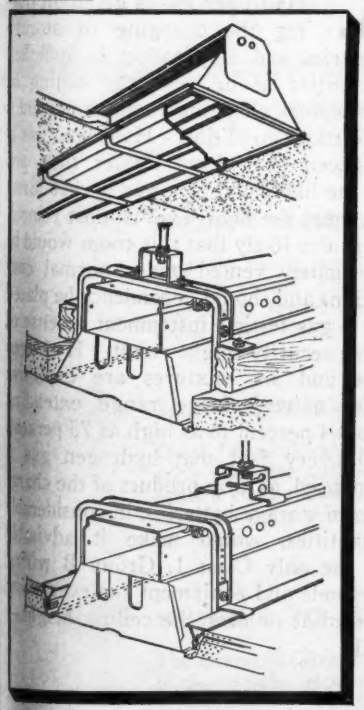


TRIPLE ROWS of cold cathode lighting form almost continuous troughs of four line 20 mm. tubing to provide this St. Louis plant with 18-22 foot-candles of good lighting. Each group of three fixtures, with twelve 6-ft. tubes, operates on the 7500-volt secondary of two, 110-volt (primary), 60 ma. transformers.



Why hang lighting fixtures from the ceiling?

This ceiling hangs from the lighting fixtures



For simpler, stronger construction in Schools, Offices, Stores & Industry

One hundred years "in lighting" has taught us many things.

Among them the fact that providing better lighting is not enough. The fixture must be designed to *solve* construction problems for architects and builders—rather than to present *new* ones.

So . . . in designing the Miller 2-light Troffer to be the world's finest continuous fluorescent lighting system for offices, stores, schools and industry, we also designed it to be the most practicable to build with—and around.

Therefore . . . the patented Miller Bracket, which makes it possible to hang the troffer from the structural ceiling and then to suspend the false ceiling (either wood or metal frame) *from the troffer.*

This effects construction economies, makes for stronger construction and adds flexibility to the entire installation.

In fact, so versatile is the Miller Troffer —in single units, unit combinations or in continuous light-strips "by the mile" —that its applications are almost as unlimited as the architect's ingenuity.

It is simple to service and so economical to operate that it encourages large installations—an important factor when the wartime bulge in industrial lighting tapers off and new users of fluorescent lighting are needed to fill the gap.

Miller Engineers are in principal cities and, as we work with all light sources, including mercury vapor and incandescent, they are unbiased. So call a Miller Engineer—or call us—and see why The Miller Company starts its *second* hundred years, still in the lead!

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

Answered by
F. N. M. SQUIRES and GLENN ROWELL
Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

QUESTIONS ON THE CODE

BONDING METAL CASES

Q. *"I have two panels that are subfed from a main externally operated switch, subfeeds are three number eights in a non-metallic uninsulated cable, service the same size and type as cable. I grounded the service neutral with a number eight wire to water piping, circuits from panels in non-metallic uninsulated neutral (wood floor construction), panels located in corridors. I bonded the metal cases with bonding screw to neutral strip in panel, no water nearby. My opinion is that they are sufficiently grounded."* —J.K.

A. The fourth sentence in new section 3372 of Interim Amendment No. 43 requires that "Distribution cabinets from which branch circuits are run, if of conducting material, shall be bonded to the grounded circuit conductor."

Note that this kind of a connection is required only where the "uninsulated" type of non-metallic sheathed cable is used in defense emergency buildings. The opinion of our inquirer is correct.—F.N.M.S.

SHALLOW OUTLET BOXES

Q. *"The Electrical Inspector recently refused to pass several wiring installations made on an R.E.A. cooperative because we had used shallow boxes rather generally throughout the dwellings. In no case had we violated the provisions of Section 3705 so we are unable to understand his action."* —S. K.

A. Just preceding Section 3705, the Code states under Section 3704 that "Outlet boxes for concealed work shall have an internal depth of at least 1½ inches, except where the installation of such a box will result in injury to a building structure or is impracticable, a box not less than ½ inch internal depth may be installed." While it is true that you did not place more conductors in any box than are permitted by Section 3705, the fact that you used shallow boxes would justify the inspector's action in refusing to pass the installations because the use of the shallow box restricts further additions to an installation. Inspectors will as a rule accept shallow boxes on porches or in closets on the ends of circuits where the likelihood of further extensions is remote and they are no doubt justified in assuming that the use of a deeper box in locations such as these may be considered impracticable. In this connection it might be well to consult your local inspection authorities as they may have some specific ruling regarding boxes.—G.R.

SELECTION OF SERVICE SWITCH FOR A MOTOR INSTALLATION

Q. *"Is it in accordance with the Code to use a general service switch for a load of two 3 hp. motors, or does it call that the main switch should be rated in hp.?*

"I understand that the disconnecting switch to the different motors is rated in hp. but as to the main switch, I could not find any ruling on how this switch should be selected."—M.Z.

A. Two sections of the Code will supply you with the answer to the above question.

Section 4408 tells us that inasmuch as more than one motor is involved, the service switch cannot serve as the disconnecting means for these two motors. Of course if the two motors satisfy the conditions in Section 4410, a single disconnecting means (but not the service switch), may serve both motors.

Section 4314 would govern the size of the service switch, as it would have to be a size to take care of the feeder to these two motors. This size would be 125 percent of the full load current of one 3 hp. motor, plus the full load current of the other.

As this service switch is neither the controller nor the disconnect for these motors, it is not supposed to be opened under load and therefore does not have to be rated in horse power.

As our inquirer did not give us the full data on the motors, he will have to figure out the switch size from the amperes given on the motor name plate.—F.N.M.S.

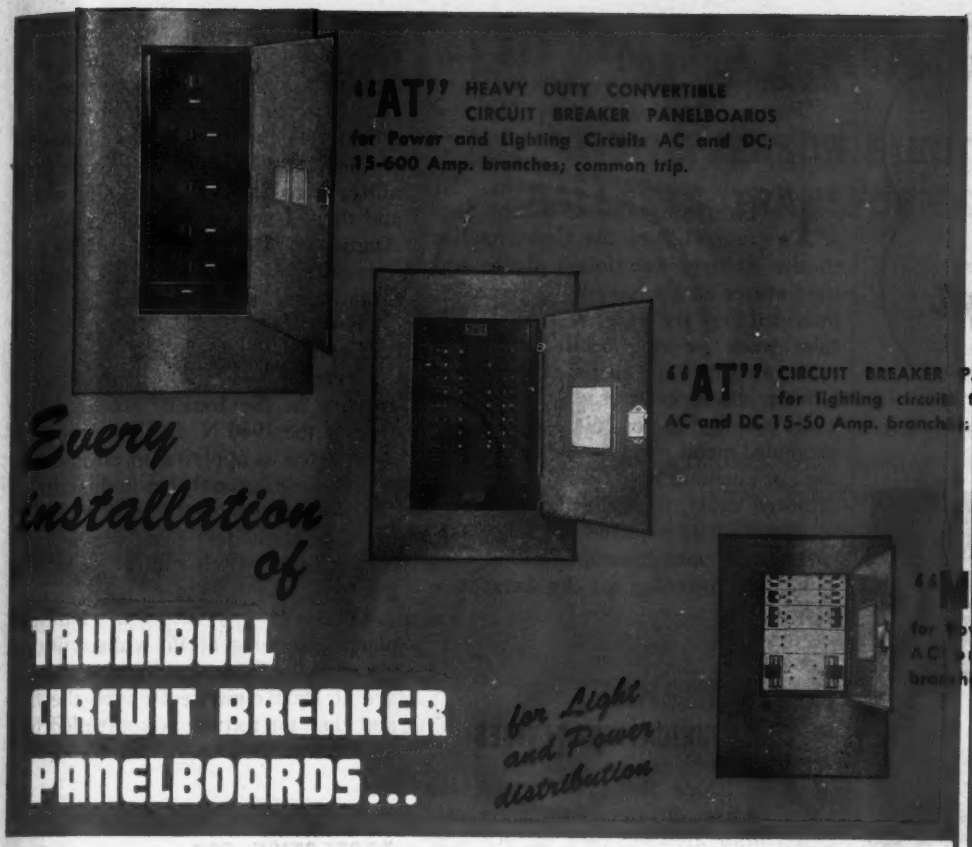
ELECTRICAL EQUIPMENT FOR CHARGING ROOM

Q. *"What type and class of electrical equipment must we install in the charging room of a storage battery factory?"*—J. A.

A. Hydrogen gas is given off during the charging of storage batteries and may collect in sufficient quantities at or near the ceiling of the battery charging room to present a hazardous condition. Hydrogen gas is fourteen plus times lighter than air, so the likelihood of a gas pocket forming near the floor level is most remote. It is also likely that this room would be adequately vented under normal conditions and should dependence be placed on a gas testing instrument a sense of false security might result. Hydrogen gas and air mixtures are explosive over a very large range extending from 4 percent to as high as 75 percent. The very fact that hydrogen gas is produced, as a by-product of the charging of storage batteries, in considerable quantities, would make it advisable to use only Class 1, Group B wiring methods and equipment for everything placed at or near the ceiling height.—G.R.

GROUNDING OF FIXTURES

Q. *"I would appreciate your clarifying the 'Code' as it pertains to the installation of small fluorescent fixtures using 20 watt lamps with ballasts in series (not transformers for increasing voltage). These*

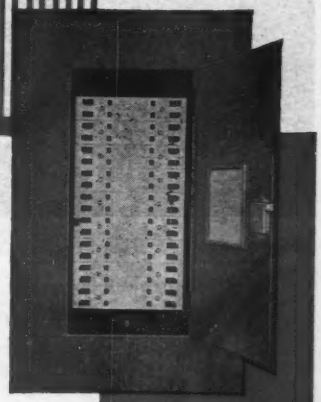


Every installation of

TRUMBULL CIRCUIT BREAKER PANELBOARDS...

for Light and Power distribution

means a 3-way improvement



IN ELECTRICAL SERVICE

1 PROMPT RESTORATION OF SERVICE AFTER INTERRUPTION

Each of these circuit breaker panelboards has its special application and capacity range. All, however, provide automatic short circuit and overload protection for electrical circuits with the assurance that service can be immediately restored after interruption (by the "flip of the breaker handle.")

2 SAFE LOADING OF CIRCUITS

These Trumbull circuit breaker panelboards are equipped with carefully calibrated and SEALED breaker units. Branch circuit loads are always adequately protected because no improper replacements of protective units can be made.

3 NOTHING TO RENEW OR REPLACE

The circuit breaker, for both power and lighting circuits, is the simple, modern, tamperproof method of circuit protection . . . with nothing to renew or replace,—reducing maintenance,—preventing delays and interruptions of important industrial and business operations.

For full information on the applications of these various types of circuit breaker panelboards, both "AT" and Multi-Breaker, write for Trumbullaid Circulars Nos. 303, 321, 325, 309.

TRUMBULL
CIRCUIT BREAKER PANELBOARDS
"AT" and Multi-Breaker

ELECTRICAL CONTROL APPARATUS
Safety Switches and Circuit Breakers . . Service Equipment . . Motor Control . . Control Centers . . Panelboards . . Switchboards . . Feeder Distribution Systems, etc.

THE TRUMBULL ELECTRIC MANUFACTURING CO. • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

A SOLUTION For Your Socket Problem



PORCELAIN

Use Porcelain Sockets — Be assured of dependable service — and at the same time conserve critical materials.

P&S Porcelain Sockets do not come under the head of "substitutes" — but are QUALITY sockets in their own right. Backed by over 50 years' manufacturing experience. Available in both One and Two-Screw types.

Send for Complete Catalog.

Sold Thru Electrical Wholesalers

P&S

PASS & SEYMOUR, INC.
SYRACUSE 9, N. Y.

are for installation on wood lath and plaster ceilings, not within reach of ground. Must these be grounded?

"Please advise if Section 4127-b-2 applies to these types of fixtures?"—W.H.

A. Sub paragraph of b-2 of Section 4127 of the Code, applies to the fixtures mentioned above and the fixtures do not have to be grounded provided they are wired with knob-and-tube work or non-metallic sheathed cable as they are installed on wood lath or plaster ceilings.

However, if the circuit is wired with grounded metal raceway (metal moulding or conduit) or with grounded armored cable, then the fixtures must be grounded as required in 4127 a. Of course the metal armor will afford sufficient grounding for the fixtures.—F.N.M.S.

ELECTRONIC INTECOMMUNICATING DEVICES

Q. *"Does the Code permit the use of electronic intercommunicating devices, such as are now available in grain elevators or flour mills?"*—L.A.

A. Dusty locations which are common to many parts of grain elevators and flour mills are considered as Class 2 Group G locations by the N. E. Code. All electrical devices used in such locations must be of the Class 2 Group G type, and inasmuch as there are no electronic intercommunicating devices approved for such use now, the answer is no. There are some elevators and many flour mills in which there are certain rooms or areas that are not subject to grain dust, and the use of such units when confined to the dust free rooms only would not be considered a violation of Article 500 of the N. E. Code.

There are several manufacturers producing dust-tight and explosion-proof telephone equipment for use in the hazardous areas, and without a doubt the electronic intercommunicating devices may be available in a dust-tight design at some future time.—G.R.

INDUSTRIAL LIGHTING FIXTURES

Q. *"I recently have noticed several articles dealing with the use of industrial lighting fixtures operating at 465 volts. Can you explain whether or not this is now permitted by the N. E. Code?"*—M.E.L.

A. Section 2105 dealing with the permissible voltages on lighting circuit is so worded that one might be led to believe that the voltage on a lighting circuit could not exceed 150 volts to ground except on railway properties. The Interpretations Committee of the National Electrical Code Committee were asked to clarify this section and they issued interpretation No. 229 August 4, 1942 and revised their findings on October 15, 1942. This interpretation reads as follows:

"It was not the intent of the Electrical Committee that the expression 'shall not exceed 150 volts to ground,' which appears in the fourth line of section 2105 of the 1940 N. E. Code, should be interpreted as applying to circuits supplying lighting only in industrial establishments where the fixtures are not less than eight feet from the floor and do not have switch control as an integral part of the fixture."

Therefore circuits in industrial plants operating at 465 volts will comply with the Code providing all fixtures are at least eight feet above the floor and that no fixture is controlled by a switch attached to the fixture.—G.R.

PROTECTION FOR INDIVIDUAL MOTOR CIRCUITS

Q. *"Is it necessary to install a main service switch ahead of three circuit breakers providing protection to individual motor circuits in a municipal water pumping station?"*—L.W.

A. The Code will permit up to six subdivisions of service without requiring a main service switch providing the switches or circuit breakers are grouped either within a single enclosure or in separate adjacent enclosures. It is possible that the specifications may require the main switch even though the Code does not, as many engineers prefer a single disconnecting means, but if that is not the case, you need not install a main service switch. —G.R.

PAPER INSULATED CONDUCTORS

Q. *"May the paper insulated conductors be used exclusively for the wiring of a small storage warehouse?"*—M.H.

A. No! The paper insulated conductor you speak of is known as type El and special permission was originally given in Interim Amendment No. 69 to use this conductor for both the grounded and ungrounded circuit conductors on an exposed knob and tube installation in dry locations in an

FOR PRESENT-DAY AND PROPOSED JOBS

Insist On



Included in the Jefferson Electric Line are types that provide in one ballast for bringing leads either out of both ends or bottom to suit the particular installation requirements. Instant starting Ballasts are available for use with two-lamp 40-watt sizes of proper characteristics.

CERTIFIED E·T·L SPEC NO 6 HIGH P.F.

FLUORESCENT LAMP

BALLASTS

Long-hour operation demands the best in fluorescent lighting and the best in Ballasts. Jefferson Electric Ballasts are available for use with all commonly used fluorescent lamps and in single- and two-lamp types. For full data, see new Bulletin 441-FL.





JEFFERSON TRANSFORMERS

FOR MERCURY LAMPS

Correctly designed and coordinated to govern the current through the starting and operating cycles of mercury lamps, Jefferson Transformers meet the most exacting requirements. They insure maintained high efficiency.

Tested and approved by Electrical Testing Laboratories of New York, they are listed also by Underwriters' Laboratories, Inc., and carry the Underwriters' Re-examination Service Label. Indoor and Outdoor Transformers are made in all standard capacities, single- and two-lamp types.

JEFFERSON ELECTRIC

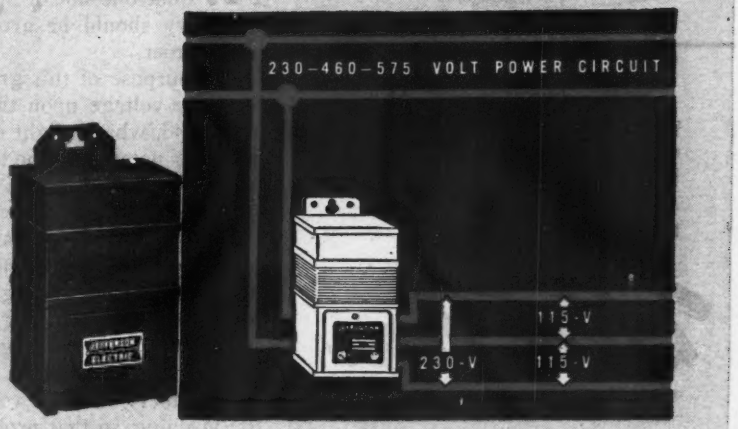
JEFFERSON ELECTRIC BALLASTS, TRANSFORMERS, FUSES

For Maximum Performance

Given first rank by experienced electrical and maintenance men for uniform quality of design and construction, Jefferson Electric Transformers, Ballasts, and Fuses invariably are specified when top performance is vital. Minimum attention and maintenance, and long life reliability mean lower overall cost.

Jefferson Electric products are handled by leading wholesalers for your convenience—specify them when ordering.

TRANSFORMERS for POWER CIRCUITS



Eliminate duplicate high and low voltage circuits. Distribute only the 230 to 575 volt service—and provide the 115 volt current where needed for lamps, small tools and appliances by means of Jefferson Electric dry type Power Circuit Transformers.

JEFFERSON UNION RENEWABLE FUSES

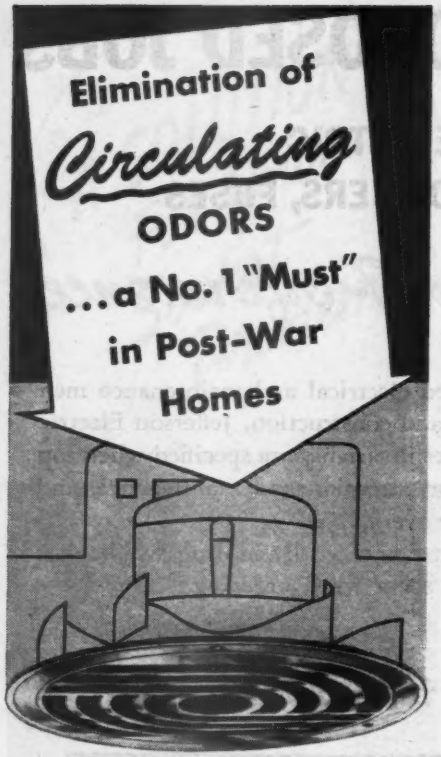
Proper fusing eliminates unnecessary shutdowns and damage to motors, wiring and equipment. Delays interfere with all-out production.

Jefferson Renewable Fuses provide the safe, reliable protection required. When excessive overloads require these fuses to open the circuit, they do it safely. Their rugged construction and simple design permit quick cleaning and easy renewal.



JEFFERSON ELECTRIC COMPANY • Bellwood (Suburb of Chicago), Illinois

In Canada: Canadian Jefferson Electric Co., Ltd., 384 Pape Avenue, Toronto, Ont.



"SPOT" ventilation—at the source of the odors—will be a demand of the post-war residential builder. In kitchen, bathroom, gameroom, laundry you'll find a No. 1 "must" for

Blo-Fan

"SPOT VENTILATION"

Blo-Fan stands alone in its unique and revolutionary principles. It combines both the volume of the breeze fan and the power of the blower. It whips up greasy vapors, steam, tobacco and and liquor fumes at the ceiling—forces them out through the exhaust duct.

Blo-Fan will offer unusual post-war profits for the electrical contractor.

WRITE FOR FOLDER

BUY U.S. WAR BONDS
Now!

PRYNE & CO., INC.
1245 E. 33rd ST. LOS ANGELES
Branches (to be reestablished after war)
SAN FRANCISCO · SEATTLE · CHICAGO · NEW YORK

attempt to conserve rubber. On April 1, 1944 the Code Committee saw fit to revise this amendment and forbid further use of type El conductor for the ungrounded wire. It would, therefore, be possible for you to use type El insulated wire as the identified neutral, but the ungrounded conductor would have to have type R or better insulation.—G. R.

ONE LIGHT TRANSFORMER GROUNDING

Q. *"On a machine fed by a three phase three wire 240 volt power line a 150 va, 240 to 115 volt transformer is connected to one phase of the power line for a machine light. Must the secondary of this lighting transformer be grounded, that is, one wire of the 115 volt lighting circuit?"* —W.F.M.

A. For strict compliance with the Code one side of the transformer secondary should be grounded at the transformer.

The purpose of this grounding is to limit the voltage upon the circuit and to ground, which might otherwise rise to higher potentials, due to lightning or transformer breakdowns or crosses.

In the case of the machine light transformer mentioned above, there is practically little likelihood of these faults occurring, as lightning would hardly get so far along on a wiring system within a building and it would take the breakdown of two or more transformers for high voltage to reach the machine, so that probably most inspection bureaus would not require the grounding of this small secondary.

With a more extensive machine involving many lights, a larger transformer and considerable circuit wiring then the grounding requirement should be adhered to.—F.N.M.S.

TRANSFORMER PROTECTION

Q. *"Our Electrical Department is planning the installation of approximately 450 Jefferson power circuit transformers of .150 k.v.a. capacity and voltage ratings of 460–575 volts primary and 115–230 volts secondary. These units will be connected to the power supply of each electrically powered machine in the shops for point of operation lighting to supplement the overhead lighting.*

"A search of the Code fails to reveal any clearly defined statement on how best to protect the primary and secondary sides of these transformers. Can you enlighten us?"—P.Z.C.

A. The ruling is to be found in 4351 of the Code.

The requirement is that each transformer shall be protected by an overcurrent device rated at not over 200 percent of the rating of the transformer.

In the case mentioned above, the rating of the transformer is .150 k.v.a. or 150 va. Assuming that the primary voltage is 460 and dividing 150 by 460 we obtain an ampere capacity of 0.32. This would make the proper fuse size 0.64 amp. for the protection of each transformer. Fuses may be obtained in ratings of $\frac{6}{10}$ amp. and $\frac{7}{10}$ amp. Either size would meet the Code but the smaller size is recommended.—F.N.M.S.

METAL STAPLES FOR REA INSTALLATIONS

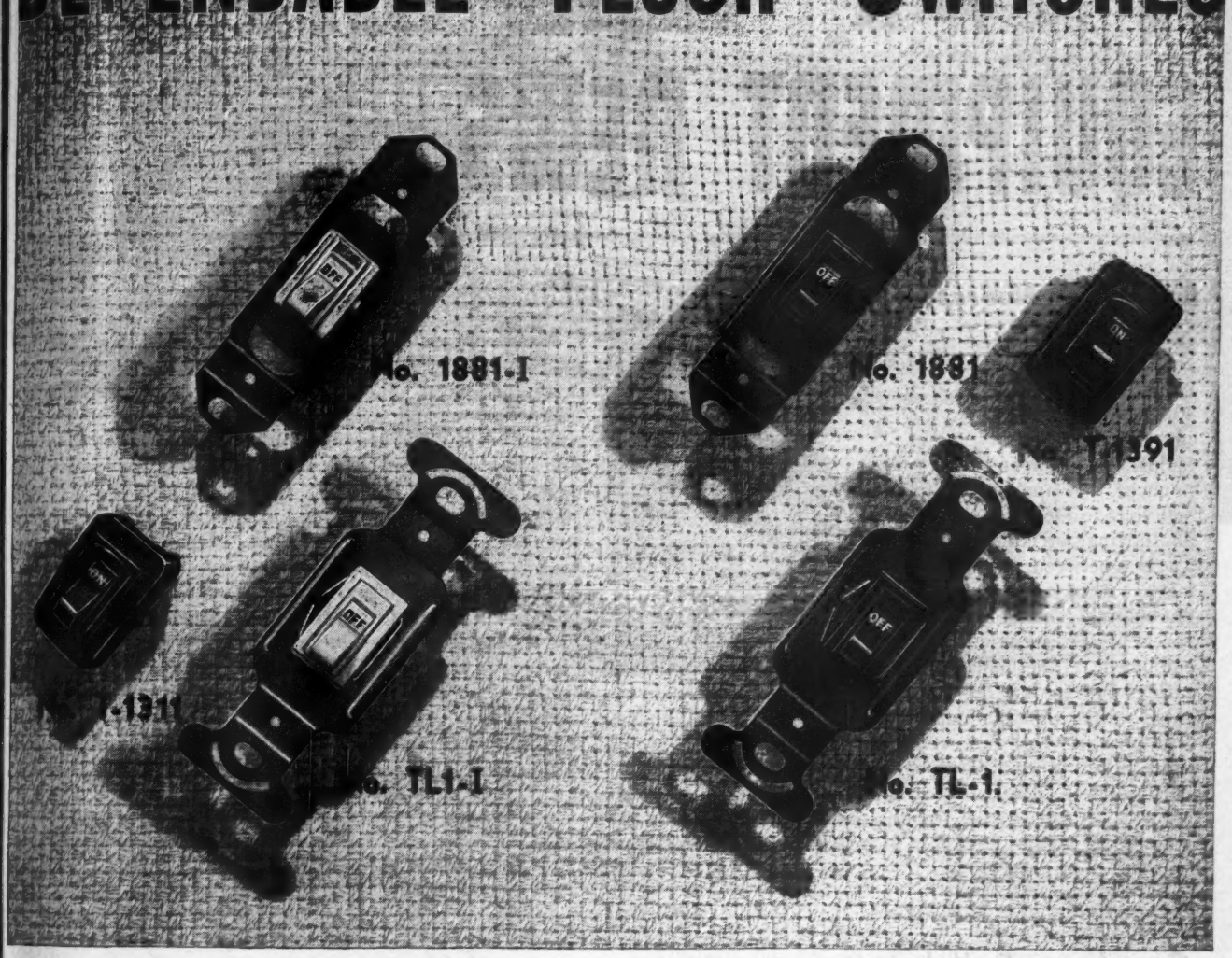
Q. *"Are there any metal staples suitable for attaching non-metallic sheathed cable on R.E.A. installations?"*—J.D.

A. There may be certain types of staples available at a later date which would be acceptable for securing cable, but ordinary armored cable or fence staples cannot be used. Section 3363 states as follows: "Non-metallic sheathed cable shall be secured by approved staples, straps, or similar fittings, so designed and installed as not to injure the cable." There are fibre headed staples available which are suitable for use in dry locations. Experience gained with rural electrification, however, has indicated that the fibre headed staples now available will not withstand the moist conditions common to buildings housing livestock during cold weather. The moist atmosphere present in most buildings of this type causes the fibre heads to swell and break away from the brads.—G.R.



INDUCTION HEATING and Dielectric subcommittee, A. I. E. E. has on its roster (L to R) engineers George W. Scott, Jr., Armstrong Cork Co., Lancaster, Pa.; J. J. Orr (chairman), U. S. Rubber Company, N. Y.; and P. Bliss, New Britain Machine Co., New Britain, Conn.

DEPENDABLE FLUSH SWITCHES



H & H Standard and Interchangeable Lines

These popular numbers provide essential types for "coming through" on residential wiring requirements. Both the Standard and Interchangeable Line switches have the same degree of dependable design and mechanism —the famous H & H "degree".

Numbers illustrated above include representatives of the "TL" Line:- single-pole, double-pole, 3-way and 4-way—residential type. Also, Interchangeable Switches to go with receptacles or other units in a single gang.

HART & HEGEMAN DIVISION

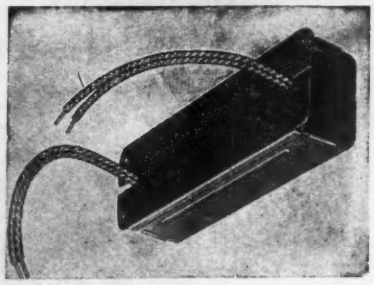
DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U.S.A.

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

Ballast for Fluorescent Lighting

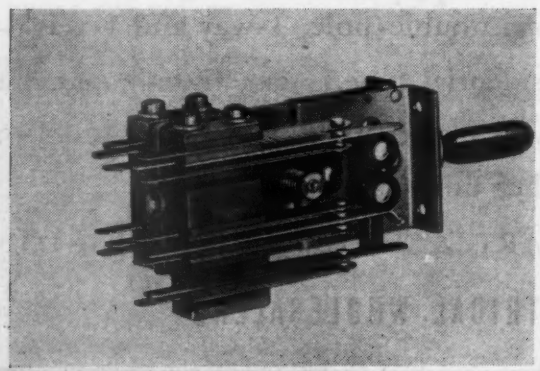


G-E BALLAST

A new high-voltage, Tulamp ballast, for the operation of 40-watt instant-starting fluorescent lamps, has been announced. It applies 450 volts to the lamp at starting, striking an arc between the lamp cathodes, and eliminating the need for separate starter equipment. The ballast is available in Tulamp 40-watt ratings for use on 118-volt circuits. The ballast delivers rated watts to the lamp at nominal circuit voltage. This design provides high power factor, gives correction of cyclic light flicker. Special filters for suppression of radio interference are used. The ballast is housed in a universal case that allows the leads to be brought out either the end or the bottom, permitting flexibility of installation. General Electric Co., Schenectady, N. Y.

Cam Lever Switch

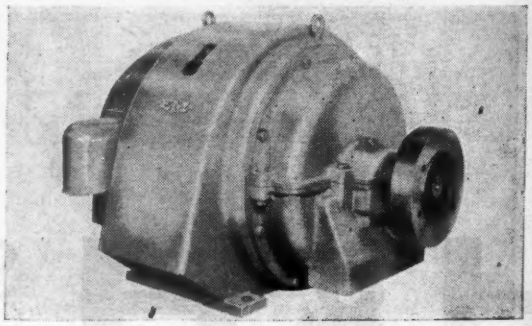
This new Master cam lever switch Model MCL-CS is designed for use on electronic and communications equipment, and wherever multiple circuits must be controlled. The positive positioning cam has roller detents which eliminate friction and contact bounce. Coil springs are used on both sides of the cam so that equalized pressure is assured regardless of the number or arrangement of contact assemblies. The switch is static shielded and is of non-corrosive construction. All contacts can be removed from frame by removing a single bolt. Contact rating is 10 amp., 125 volts a.c. and 2 amp., 125 volts d.c. General Control Co., 1200 Soldiers Field Road, Boston 34, Mass.



GENERAL CONTROL SWITCH

Induction Motor

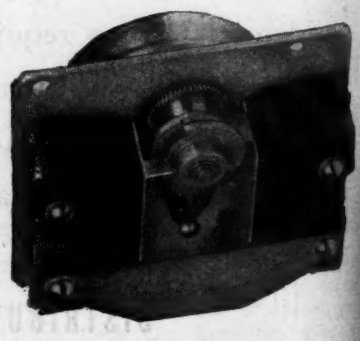
A new line of large, heavy-duty induction motors for all types of industrial, power plant, water works and other drives, has been announced. Motor sizes range from 200 hp. to 1000 hp. and are available in squirrel cage and wound rotor models. The heavy, reinforced motor frame construction is of fabricated steel plate, or close-grained cast iron depending on the size and type of motor. Form-wound stator coils have multi-layer insulation with high dielectric strength and moisture resistance. High thermal capacity, brazed cage winding, on squirrel cage motors. Well insulated, strongly braced rotor winding on wound-rotor motors. Cool motor operation is provided by rotor fan and conical baffling. One-to-one ratio sleeve bearings are standard. Ball or roller bearings can be supplied. Protective enclosure for drip, splash or other special conditions and enclosed construction for direct ventilation can be furnished. Electric Machinery Mfg. Co., Minneapolis 13, Minn.



E-M INDUCTION MOTORS

Time Delay Relay

This new Type TDSA and TDSB time delay relay has been designed to provide a varied operation of one circuit in relation to the second circuit. It is arranged for surface mountings either front or rear connections and is especially designed to withstand momentary shock conditions. The R. W. Cramer Company, Inc., Centerbrook, Conn.



CRAMER RELAY TDSA

12 REVISED SPECIFICATIONS
FOR INDUSTRIAL LIGHTING

Ready for Your Use Early in August



RLM Specification No. 1—
Dome Reflector

RLM Specification No. 2—
Deep Bowl Reflector

RLM Specification No. 3—
Symmetrical Angle Reflector

RLM Specification No. 5—
48" Fluorescent Two-Lamp Closed-End Porcelain Enamel Unit

RLM Specification No. 6—
48" Fluorescent Three-Lamp Closed-End Porcelain Enamel Unit

RLM Specification No. 7—
60" Fluorescent Two-Lamp Closed-End Porcelain Enamel Unit

RLM Specification No. 8—
60" Fluorescent Two-Lamp Closed-End Porcelain Enamel Diffuser Unit

RLM Specification No. 9—
48" Fluorescent Two-Lamp Open-End Porcelain Enamel Unit

RLM Specification No. 10—
48" Fluorescent Three-Lamp Open-End Porcelain Enamel Unit

RLM Specification No. 11—
60" Fluorescent Two-Lamp Open-End Porcelain Enamel Unit

RLM Specification No. 12—
60" Fluorescent Two-Lamp Open-End Porcelain Enamel Diffuser Unit

★RLM Specification No. 18—
Glassteel Diffuser

STILL AVAILABLE

RLM Emergency Specification No. 15—
48" Fluorescent Two-Lamp Open-End Non-Metallic Reflector Unit

RLM Emergency Specification No. 16—
48" Fluorescent Three-Lamp Open-End Non-Metallic Reflector Unit

RLM Emergency Specification No. 17—
60" Fluorescent Two-Lamp Open-End Non-Metallic Reflector Unit

★New RLM Approved Unit

● Latest specifications for industrial lighting units built to RLM Standards are listed in panel at left. These revised RLM specifications, representing months of careful engineering study, research and tests, establish a new high standard for light output efficiency in RLM labeled industrial lighting fixtures.

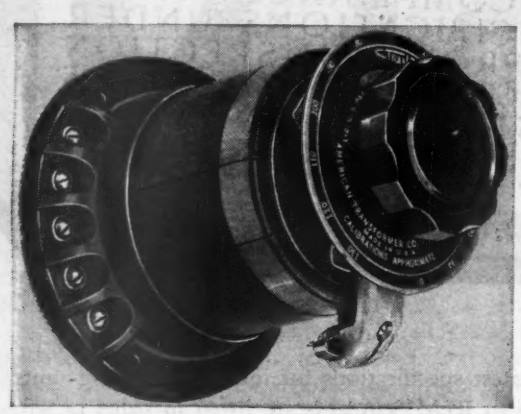
Through the use of these new RLM Official Standard Specifications, covering vital construction and performance for each of the 12 reflectors and Fluorescent Lighting Units listed, you secure positive assurance that your RLM Certified Products provide the maximum in lighting efficiency and economy.

All industrial lighting units certified by RLM Institute to conform to these up-to-the-minute specifications are identified by the RLM LABEL. Copies of the revised RLM Specifications can be secured from manufacturers using RLM inspection and certification service, or direct from RLM Standards Institute.

RLM STANDARDS INSTITUTE
INCORPORATED

Voltage Regulator

A new small TH Transtat a.c. voltage regulator has been developed. The brush arm which permits good heat dissipation, provides a simple means of changing brushes and protects the commutator against short circuiting contact with the brush holder. The shaft is independent of the brush arm assembly and can be removed by drawing one pin. Therefore, the unit can be quickly changed from panel mounting to table mounting or ganged with other units for polyphase or simultaneous single phase control. Some of the refinements incorporated in the new unit are vinyl acetal insulated wire, impregnation of core and coil with a synthetic phenolic resin varnish of the polymerizing type, followed by baking, corrosion-resistant fittings, and a new dual mounting arrangement for open delta three phase control that reduces waste space. American Transformer Co., 170 Emmet St., Newark, 5, N. J.



AMERICAN TRANSFORMER TRANSTAT

Infra-Red Lamp



WABASH LAMP

A new 375-watt reflector type infra-red lamp has been added to the Birdseye line. The new lamp is made in clear and ruby glass. Known as RE-40 it is designed to produce higher drying temperatures. Some of the advantages of the new lamp are heat-proof Superlok base, more efficient and durable ceramic heat reflector disc, tungsten "M-Filament" and built-in reflector. Wabash Appliance Corp., 335 Carroll St., Brooklyn 31, N. Y.

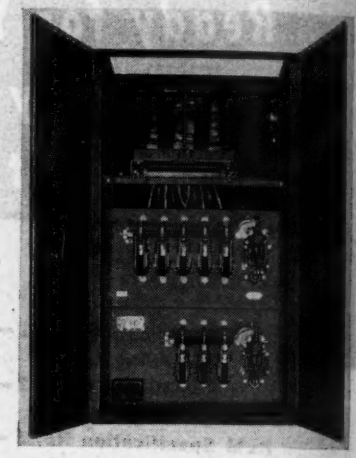
Time Delay Relay

Model TD6 time delay relay is for the protection of transmitter and electronic tubes. It has cam-operated switch mechanism mounted in dust and moistureproof bakelite case for panel mounting. It has a visible index showing open and closed position by means of graduated indicating dial. It has four screw type terminals for motor and switch circuits. A totally enclosed switch unit is used. This switch has definite snap action and positive lock in both operating positions. The R. W. Cramer Co., Inc., Centerbrook, Conn.



CRAMER RELAY

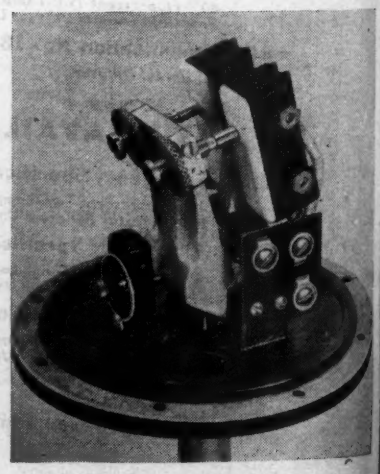
Magnetic Motor Starter



ALLIS-CHALMERS STARTER

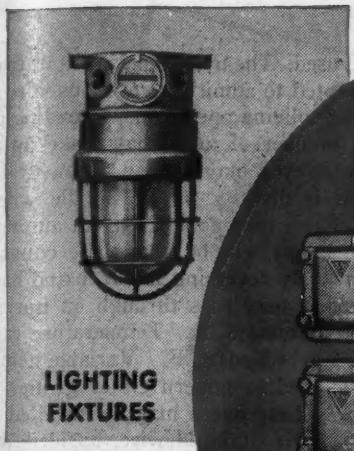
A new magnetic, reduced voltage cage motor starter, which protects motors from sustained overloads, locked rotor condition, single-phasing and overloading from too frequent starting, has been announced. It is known as the type "ARC" starter and has an accurately calibrated, thermal overload relay. Built for general industrial applications, the new starter is now available for control of motors from 5 to 2,500 hp. up to 5,000 volts, 3-phase, 50 to 60 cycles. Reduced voltage, two-point starting is obtained with a built-in auto-transformer, utilizing accurate, synchronous motor-driven, adjustable timing relay for transition from starting to running position. Units rated through 800 hp. have built-in auto-transformers; above 800 hp., auto-transformers are furnished for separate mounting. Interrupting capacity rating of the new starter is ten times the motor's full load current. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

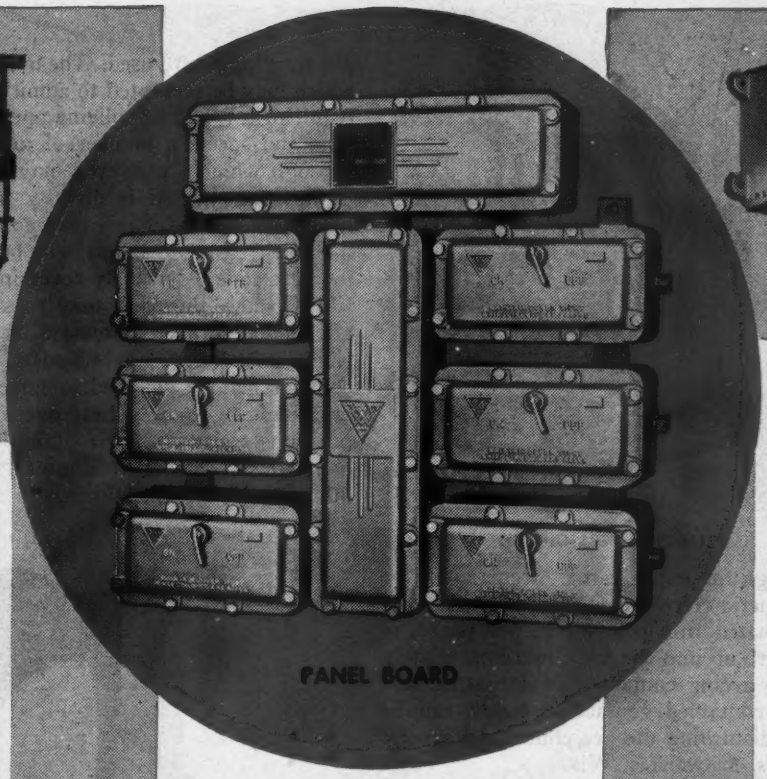
Temperature Limit Switch

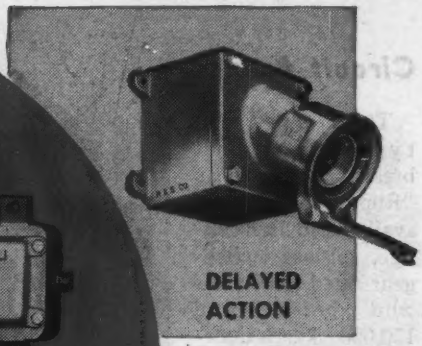


TEMPERATURE CONTROL SWITCH

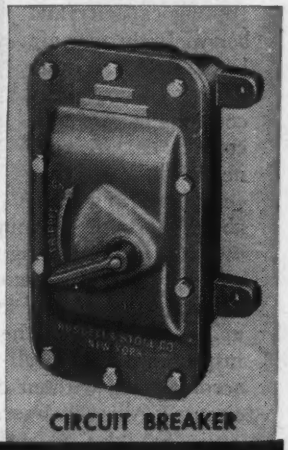
A new Model VD-2C has been added to this line of temperature control limit switches. It has a water and vapor tight sheet metal cover. The switch adjusting screws have locking screws instead of disks to lock adjustment. Main temperature can be easily locked in place with a screw driver. Simplified wiring connectors are made through a ½-in. pipe tapped hole in base. The switch can be used for any temperatures from minus 100 to 1400 deg. F. Burling Instrument Co., 253 Springfield Ave., Newark, N. J.











ELECTRICAL SAFETY . . .

in Hazardous Locations

Since 1902
the
standard for
CHEMICAL
FOOD
MARINE
POWDER
REFINERY
TEXTILE
and all outside installations

That is what R&S fittings and fixtures have achieved since 1902. As industry expanded, resulting in greater volumes of industrial dust, new processes and ever larger hazardous areas, R&S pursued a policy: "If we don't have it, we'll make it."

The result is a single catalog of 300 pages of the largest and most complete line of fixtures and fittings designed exclusively for the hazards of moisture, liquids, dust and gases of all kinds.

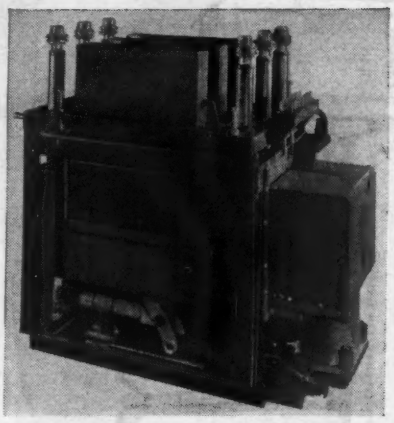
You may not need a delayed action switch, or a light that will work under water, but most of the industrial, outdoor and marine jobs you are considering should be protected against moisture, dust or explosive gases for a life-time with R&S products.

If you make electrically operated equipment that is to work under these hazards, it should be equipped with R&S products before it leaves your plant.

Leading electrical jobbers, engineers and contractors have the latest R&S Catalog (No. 90), and can give you good service and good advice.

RUSSELL & STOLL COMPANY
EXPLOSION-PROOF WATER-TIGHT AND EVER-LOK RECEPTACLES, PLUGS, CONNECTORS, SWITCHES AND FIXTURES
125 BARCLAY STREET • NEW YORK 7, N. Y.

Circuit Breaker

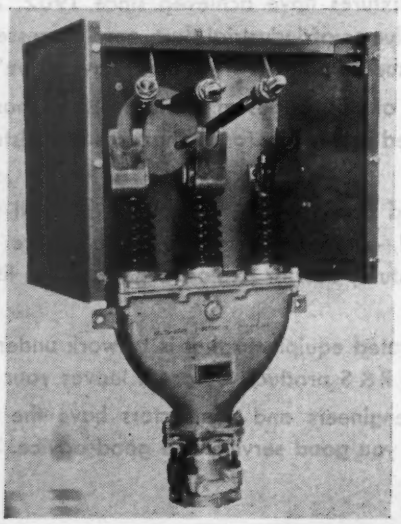


ALLIS-CHALMERS CIRCUIT BREAKER

This new magnetic type air circuit breaker is known as "Ruptair". It is available in high voltage, oil-less switchgear rated 5,000 volts and below and 150,000 kva. interrupting capacity and below. In the new air breaker the arc chute has been carefully coordinated with the contact and arc runner design to give consistent and reliable interruption through the entire range of current to be interrupted. The magnetic circuit, consisting of one blowout coil and two laminated iron pole pieces per phase, is arranged to force the arc up into the arc chute immediately upon separation of the arcing contacts. Maintenance and inspection of the self-contained contact assembly can be accomplished without disturbing the arc chute or magnetic circuit. Allis-Chalmers, Milwaukee, Wis.

Cable Terminator Unit

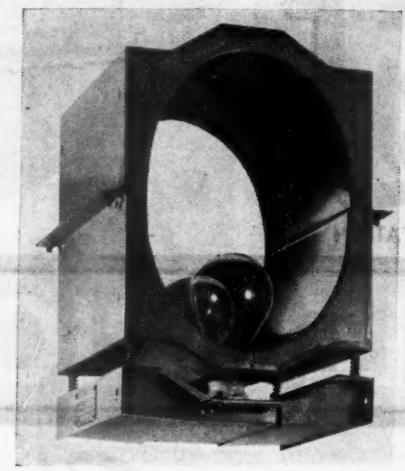
This outdoor cable terminator is for use in making cable connections to high voltage large capacity three-phase motors. The sealed top terminator has a stuffing box entrance for three single conductor cables. The motor can be disconnected by loosening three stud connectors. Disconnecting type aerial lugs absorb vibrations from motor leads to the terminator bushings and allow for alignment variations. Delta-Star Electric Co., Chicago 12, Ill.



DELTA-STAR TERMINATOR

Infra-Red Oven

The operation of this new elliptical infra-red oven is based upon the theory of an ellipse which has two centers or foci. The lamps are placed in one of these and the work in the other. Inside size of the standard units is 9 by 12-in. and 250-watt lamps are used. The oven is designed in two halves which may be separated to admit a continuous wire or cable requiring a repair or splicing operation. Depending upon the time and speed, a number of units may make up an oven through which a conveyor may pass in the neutral portion of the oven which is directly in the middle where very little heat exists. Parts may come from an automatic dip, in which case the lamps will be above the conveyor and the heat zone below. By reversing the oven and having the lamps below, the parts may pass through on upright pins, after being sprayed automatically. Temperature range possible is 70 deg. F. to 400 deg. F. Variable temperature controls can be included to govern either groups or units or the entire oven. These ovens may be installed in many positions—vertical, horizontal, sidewise, upsidedown, at an angle, etc. Infra-Red Engineers and Designers, 1633 E. 40th St., Cleveland, Ohio.



INFRA-RED OVEN

Lacing Cord

This new Bind-Tite lacing cord, Grade R80, is used to lace or tie together electric wire or cable in electronic, switchboard, etc. work in place of the waxed twine. Some of the advantages claimed for this cord are: it will not be eaten by termites or other tropical insects. It is elastic and will retain its elasticity indefinitely. It is not affected by climatic extremes of heat or cold. The Art Chrome Co. of America, 141 Malden St., Boston 18, Mass.

Fluorescent Lamp Starter



LLOYD STARTER

This fluorescent lamp starter is a new automatic lock-out reset type. When a lamp becomes defective and flickers or blinks, this automatic starter cuts off all current from the entire unit, ballast and lamp. Because all current is cut off, overheating of the ballast is prevented. When the defective lamp is replaced with a new one, the starter resets itself automatically and lights the lamp. One of the features of the starter is the plastic can. The can is sealed and has no projecting lugs to cause trouble. The knurled rim insures positive grip for inserting or removing starter. Lloyd Products Co., Providence, Rhode Island.



MORE THAN CODE REQUIRES

PARANITE WIRE AND CABLE CORPORATION

JONESBORO, INDIANA

Division of

ESSEX WIRE CORPORATION

FT. WAYNE, INDIANA

PRACTICAL ARTICLES on the application, installation and maintenance of electronic apparatus in industry. Readers are invited to contribute items from their experience to this department. Articles used will be paid for.

ELECTRONICS

Installing, Maintaining and Servicing Photoelectric Relays—I

By E. B. McDowell

Electronic Control Section
Industrial Control Engineering Div.
General Electric Company

THE photoelectric relay is one of the oldest and best known of the industrial electronic devices. Its field of application has grown steadily during the past ten years and at the present time new uses are still being discovered which improve speed, accuracy, and economy. Since photoelectric equipment has been used for counting, sorting, signaling, regulating, measuring, controlling, and inspecting, it is easy to visualize the extent of its applications.

In dealing with photoelectric equipment one is confronted with optics, electronics, and mechanics. But to be able to do a satisfactory job of installation, maintenance, and service, it is not necessary to have a thorough education in each one of these subjects. However, with a knowledge of the maintenance and servicing of electronic equipment together with information on the specific device obtained from the manufacturer's instructions and the use of a reasonable amount of good judgment, the majority of common troubles can be prevented or, when they do occur, can be readily corrected.

With proper care, photoelectric equipment will give years of reliable service. Even though maintenance is minimized by the use of the very few moving parts, it cannot be neglected entirely. Inadequate maintenance will cause failure of photoelectric equipment as surely as inadequate lubrication of moving parts will break down machinery.

It is well known that there are many different types of photoelectric equipment. This article discusses the installation, maintenance, and servicing of only the general purpose light sources and relays. These are ordinarily used to provide the opening or closing of an electrical circuit by a change of illumination on a phototube.

Installation of Light Sources

In practically all applications of the general purpose relay, some form of artificial illumination is employed. Although this illumination can be obtained from light sources of several different types, the one most frequently used consists of an ordinary 6-volt automobile headlight lamp and a lens or reflector. For industrial service, the lamp is usually operated at 4.5 to 5 volts in order that a life of several thousand hours may be obtained. When six volts are applied, the life expectancy of the lamp is only 100 to 200 hours.

Most light sources are equipped with 32-candlepower lamps. Unless recommended by the manufacturer, it is not advisable to substitute a 50-candlepower lamp in order to obtain more light. The increase in illumination will usually be small and the additional heat may cause trouble on units designed for smaller lamps.

When a light source is installed, it is essential that a substantial support be provided which will be resistant to vibration or shock, in order to keep the narrow beam concentrated on the phototube or its light-collecting lens. Vibration might also cause rapid deterioration of the contact material in the center of the lamp base, and the resulting increase in contact resistance would cause a decrease in lamp intensity. If the light source is located where personnel or mobile shop equipment may strike it, some form of protection should be provided.

Wherever possible a horizontal beam is to be desired. Dirt will not collect on a vertical lens surface as readily as one which is facing upward. The light beam should never be directed across a space where columns of steam or vapor may pass through the beam or condense on the lens. A condition of this sort will cause diffusion of the light and result in possible false operations.

Adequate wire size must *always* be used between the low-voltage winding of the light source transformer and the lamp to minimize voltage drop in the wire. This voltage drop, if allowed to exceed 0.2 to 0.3 volt, will result in an appreciable reduction in illumination. No. 16 wire or larger is suitable for distances between transformer and light source up to 10 feet, and No. 14 for distances between 10 and 20 feet. For any greater length, a wire size should be chosen which will keep the voltage drop within the limits given above. The current taken by a 32-candlepower lamp is approximately 3.5 to 4 amperes.

Proper adjustment of the light source is essential in securing the maximum performance of any photoelectric installation. This adjustment, ordinarily referred to as focusing, is per-



How Induction Heating Corporation Puts Electronic Heat on the Production Line

HEAT-TREATING steel in an oven is slow; in a flame, destructive; but put that steel in a high-frequency electric field, and it can soar to red heat in a matter of seconds.

This type of heating—called "electronic" heating when the high-frequency power is generated by electron tubes—has wide application in industry.

In one form (induction heating) it heats metals for hardening, annealing, brazing and soldering operations. It is also used to heat metals sealed within glass. In another form (dielectric heating) it heats wood, paper, glass, ceramics, plastics, foods and chemicals (such as penicillin solution).

Electronic heating can be slow or swift. Heat can be localized, or uniformly distributed. Ovens are eliminated, hence waste heat and time lag required to heat the oven disappear. No flame is involved; surface scale is seldom a problem. Operators work in greater comfort. Heating can be automatically time-controlled to reduce human errors.

Induction Heating Corporation, 389 Lafayette Street, New York City—a leading manufacturer of electronic heating equipment—devised the system illustrated above—wherein a series of steel slugs is fed through a high-frequency coil. Each slug is ⅞ by ⅝ inches diameter—takes just 78 seconds to travel through the coil and to come up to a uniform temperature of 2200° F! Every six seconds a slug comes through—ready for the forging operation which follows. The "Thermonic" unit shown above, built by Induction Heating Corporation for this application, uses RCA power oscillator tubes (type 892) to supply high-frequency power.

Remember...the Magic Brain of all electronic equipment is a Tube...and the fountain-head of modern Tube development is RCA! RADIO CORPORATION OF AMERICA, Tube & Equipment Department, Room 661, Camden, New Jersey.





BUY MORE BONDS...AND KEEP 'EM

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.



FOCUSING LIGHT source by adjusting lens barrel in order to obtain maximum illumination at phototube. (Figure 1)

formed by varying the distance between the lamp and the lens or the reflector (Fig. 1). The best method is to place a piece of white paper at the location of the phototube and then focus the light source until the image of the lamp filament is most clearly defined. Next the image is thrown slightly out of focus by decreasing the distance between the lamp and lens or reflector. This produces a uniformly lighted area of maximum intensity. If these instructions are not followed, it is quite possible to have the effective illumination reduced as much as 50 percent.

The a.c. supply voltage to the light-source transformer should be maintained within plus or minus five percent of the nominal line voltage. The importance of this is apparent from the fact that the illumination varies approximately three times as much as the supply voltage. For example, a five percent drop in line voltage will produce a 14.5 percent decrease in illumination and a 10 percent drop in voltage will produce a 27 percent decrease in illumination. With a relay installation in which the light is changed 27 percent by the intercepting medium, a 10 percent decrease in voltage would produce the same effect and cause a false operation of the relay. Excessive line voltage regulation can be greatly improved by the use of a constant-voltage transformer. Commonly available types will maintain the supply voltage to within plus or minus one percent for a total line variation of 30 percent.

Maintenance

Although only a negligible amount of maintenance is required for a light source, it is still something which must not be neglected if reliable service is expected of the equipment. Lamp replacement will have to be made whenever burnout occurs. If some conveyor line or machine may be shut down as a result of a lamp failure, it is much better to replace the lamps on some definite schedule of 1000 to 3000 hours instead of waiting until burnout occurs.

Lenses should be cleaned whenever necessary. Frequency of cleaning depends entirely upon the conditions of the atmosphere in which the light source is installed and the position of the lens. In a very dusty atmosphere it might be necessary to clean the lens as often as once a week or less. Under normal conditions once every three to six months might be sufficient. Since dust collects readily on the upper side of a horizontal surface, lenses facing upward will require more frequent cleaning than those facing downward or mounted vertically. The method used for cleaning depends upon the nature of the accumulation of the lens. A light film of dust can be removed by an air supply or by dusting lightly with a clean cloth. An accumulation resulting from dirt and oil vapors will have to be cleaned by the use of some solvent followed by soap and water, or prepared lens or window cleaners. Most lenses can be readily taken out for cleaning by removal of a locking ring. In doing so, precautions should be taken not to disturb the adjustment of the light source.

Periodic inspection should also be made of the light beam alignment and focus to be sure that they are in proper adjustment.

Photoelectric Relays

The light developed by the source is usually either transmitted directly to the photoelectric relay, or to some surface such as a mirror or sheet of paper and then reflected to the relay. The photoelectric unit consists of a phototube, an amplifier circuit employing one or more electronic tubes, and a contactor or relay, the contacts of which are used to control some electrical circuit. Due to the wide variety of operating conditions imposed on these devices, a number of different types have been made available. These relays differ in regard to sensitivity, time of response, location of phototube in the same case as the relay or separately mounted, type of electronic circuit, and type of enclosure. The light may strike the phototube directly or may be received by a lens and then focused to a small area on the phototube cathode.

Installation

The relay enclosure should always be mounted on a rigid support which is not subjected to any appreciable vibration or shock. Vibration or shock may not only be injurious to the tubes, but may also loosen the leads in the circuit. Where such conditions must be tolerated, some sort of cushioning with rubber, felt, or springs should be provided.

Where a separate phototube holder is used, the same precautions should be applied in its mounting. In locations where it is possible for the holder to be struck by personnel or mobile shop equipment, it is advisable to protect the holder with some form of guard.

The temperature of the air surrounding the relay enclosure should not exceed 40 C. In the case of an extended phototube holder, the temperature of the housing or the air surrounding it should not exceed 100 C for red-sensitive phototubes or 50 C for blue-sensitive tubes. Neither the relay case nor the holder should be mounted directly on a hot surface. This would raise the enclosure temperature by conduction.

Standard controls should not be installed where abnormal atmospheric conditions exist, such as steam, moisture, corrosive vapors, explosive gases, or dust. Where such conditions must be tolerated, special equipment should be used.

The phototube housing should be located so as to minimize the entrance of any light other than that from the source. On indoor installations care must be taken to exclude extraneous light from large lamp bulbs located in the proximity of the light beam, from daylight coming through a window, or from light, either artificial or daylight, being reflected from mirrors or highly polished surfaces to the phototube. In most cases the proper positioning of the phototube unit or the addition of suitable shades will eliminate the possibility of trouble from these sources. A rough check on the presence of extraneous light can be made by adjusting the relay to its most sensitive setting with the light source off, and then noting whether the relay can be made to operate by passing an opaque object back and forth directly in front of the phototube. The results of a test of this kind are not entirely conclusive because the presence of some stray light can be tolerated if the illumination level from the light source is quite high. However, if the illumination level is low, that is, when the operating distance is near the maximum, then very little stray light can be tolerated.

In one case a photo-electric relay seemed to operate satisfactorily during the morning and early afternoon, but occasionally during the late afternoon it would cease to function. Investigation disclosed that the afternoon sun shining through the window was directly in line with the phototube unit and thus provided adequate light to keep the relay energized even though the light beam was cut off.

Because of this extraneous light con-

Whatever the lighting problem

SOLA makes the correct

TRANSFORMER

Lighting was called upon to do a tremendous job in 'round-the-clock war production. Lighting did it—in the factory, in the office, in the home. Lighting methods have changed and the transformers that supply the power have changed with them.

In effecting these changes in transformer design SOLA engineers have contributed an impressive array of *original* engineering concepts.

War-time restrictions still surround many of the transformers that we are now manufacturing for important assignments in the war effort—yet the day is not far distant when these new designs, priority free, will be available to the lighting industry.

FLUORESCENT LIGHTING. In this important field SOLA'S new transformers have been closely aligned with the new developments in tubes and fixtures. Our ballasts for long continuous lamps, in which we have included our famous Constant Voltage principle, have been responsible for the unvarying light intensity in hundreds of important war plants regardless of the unstable voltages induced by unpredictable power demands.

SOLA transformers for fluorescent lighting still rate top preference with important fixture manufacturers. Ask for Bulletin JFL-86.

SERIES LIGHTING. For street lighting, protective lighting, runway markers, flood lights—wherever the power supply must be sealed against dust, moisture and weather, SOLA'S new Series Transformers have excelled in performance under the most exacting military requirements. Ask for Bulletin JSS-97.

POWER DISTRIBUTION transformers of the conventional double wound, auto types, either step-up or step-down, have also been modernized to meet changing conditions. Ask for Bulletin JDW-101.



MERCURY LAMPS • STREET LIGHTING • FLUORESCENT • AIRPORT LIGHTING • PLANT LIGHTING

SOLA

Lighting Transformers

Transformers for: Constant Voltage • Cold Cathode Lighting • Mercury Lamps • Series Lighting • Fluorescent Lighting • X-Ray Equipment • Luminous Tube Signs Oil Burner Ignition • Radio • Power • Controls • Signal Systems • Door Bells and Chimes • etc. **SOLA ELECTRIC CO., 2525 Clybourn Ave., Chicago 14, Ill.**

dition, indoor-type relays are not ordinarily suitable for outdoor use. For this type of service, on short distance installations (200 ft. and less) a long focal length lens is quite commonly used with the phototube for the purpose of rejecting most of the stray light without reducing the light from the source. For long-distance operation outdoors, special equipment using modulated light is usually employed.

Because the phototube has a high plate resistance and therefore requires a load resistor of 3- to 10-million ohms, it is essential that the resistance to ground of all circuits associated with the phototube be maintained as high as possible. This includes sockets, cable, and terminal boards. Relays equipped with an extended phototube holder are provided with a special shielded cable which has a high insulation resistance. If a replacement or extension of the cable is made, it should be of the same type and its insulation resistance should measure at least 500 megohms. It is not advisable to splice this cable but if it must be done, the splice should be covered with varnished cambric followed by a good quality rubber tape. Ordinary friction tape should not be used. When shielded cables are spliced, the shields of the two cables must always be connected. Whenever the phototube cable is extended, the time of response of the relay will be made longer, and in some relays the sensitivity will be reduced considerably. The cable to a phototube must always be shielded. Since the phototube current never exceeds 20 microamperes, the size of the wire is unimportant.

Leads to the phototube should not be run in the same conduit with the power wiring because transient voltages caused by switching in the power circuit may be induced into the sensitive phototube circuit. For the same reason, the phototube leads should not be cabled to the power leads within the case, but should be kept separated as much as possible. It is common practice to design photoelectric equipment with the power circuits and the phototube input circuits separated as much as mechanical construction will permit.

The supply voltage should be maintained within plus or minus five percent of the rating stamped on the panel nameplate. Continuous operation of the relay at any appreciable voltage above or below its rating is detrimental to tube life. A constant-voltage transformer can be used to compensate for poorly regulated power supply. In most cases this transformer can be used to supply both the relay and light source. If the line voltage is low but has satisfactory regulation, a small auto-transformer can be used to boost the voltage.

It is advisable to provide fuses in the power supply to all relays. Since most relays rarely take more than 50 volt-amperes, the ordinary circuit breakers and fuses commonly used do not furnish adequate protection. A one-ampere fuse should be suitable for most installations.

A number of photoelectric devices use the telephone-type relays with small contacts usually rated about ½ to 2 amperes, a.c. inductive load. When these relays are used to control a.c. magnetic devices such as small contactors and solenoids, it is usually advisable to place a capacitor of about 0.25 to .5 microfarad across the coil of the magnetic device to reduce sparking at the contacts. This will increase the contact life and is especially desirable for a device being used for high-speed counting operations where contacts make-and-break rapidly for long periods at a time.

Adjustment

After the light source and relay have been installed, the equipment should be properly adjusted (Fig. 2). It is common practice to direct the light toward the phototube, turn one of the adjustments until the relay operates, and then assume that the equipment is ready to be placed in service. Satisfactory performance might be obtained with this manner of adjustment under certain conditions of operation but in general trouble will probably occur later.

The first step in setting up an installation is to focus the light source properly as described previously. When this is finished, the phototube or its lens should be in the center of the light source image and the illumination will be at its maximum. If the installation is to be operated by complete cut-off of the light beam, the next step is to reduce the light by covering the phototube opening or the lens at least 50 percent with an opaque object, and setting the light level adjustment at the point where the relay just operates. This should be checked several times by gradually cutting off the light and, if necessary, making slight readjustments so that the relay operates when the light to the phototube is reduced approximately 50 percent.



ADJUSTING ILLUMINATION level control of a photoelectric relay. (Figure 2)

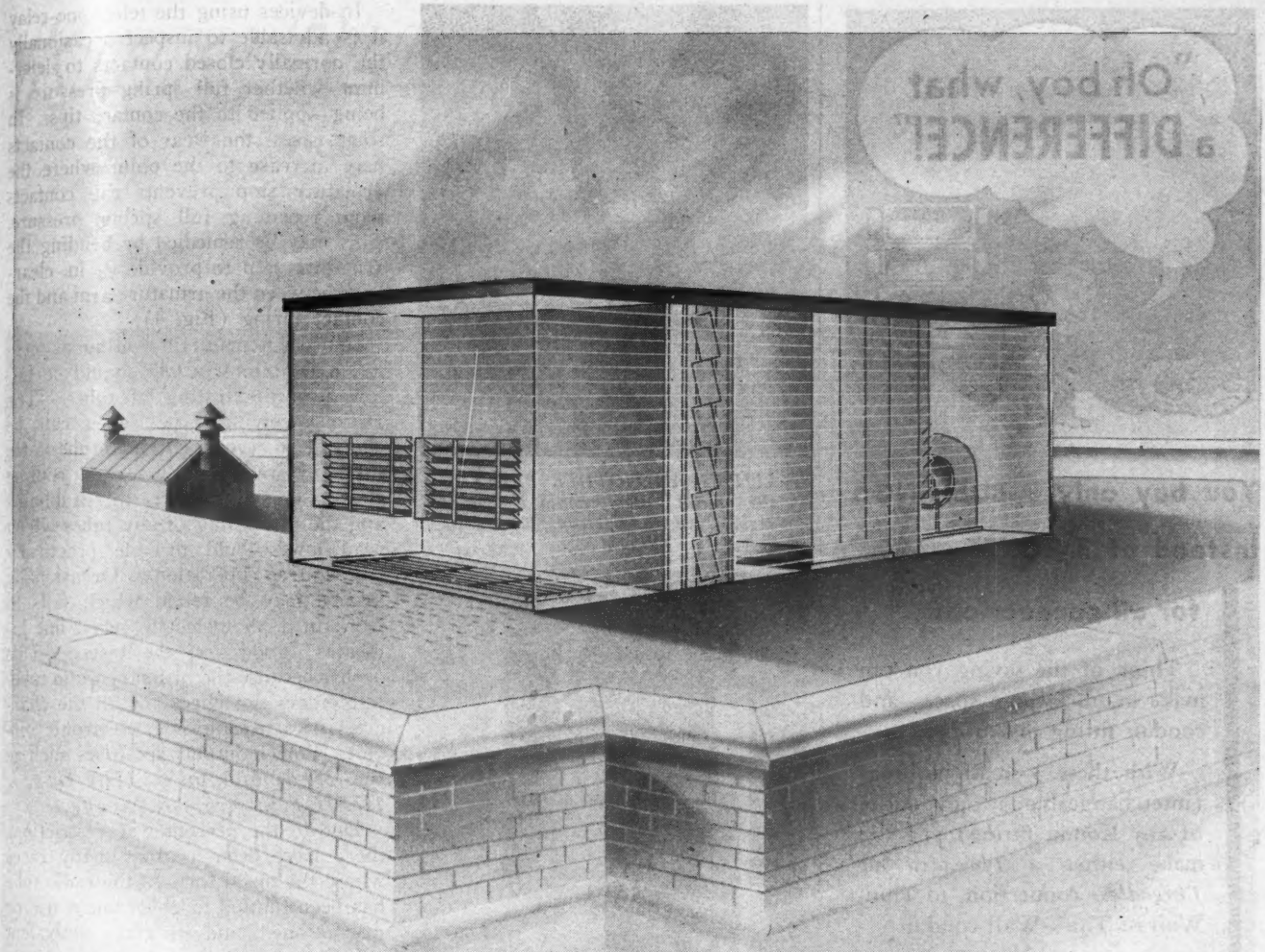
The purpose of this method of adjustment is to provide sufficient safety factor to take care of conditions which may reduce the light and cause false operations. These conditions may be low line voltage, lamp aging, or accumulation of dust on the lens. The percentage of light cut-off for which any installation can be adjusted depends upon the light intensity at the phototube and the sensitivity of the relay. If atmospheric conditions may cause an appreciable attenuation of the light over a short period of time, it is essential that the relay is adjusted to operate when 60 to 90 percent of the light is cut off. However, in adjusting for this condition of operation, the optimum sensitivity setting of the light level control should not be approached so close that small changes in line voltage will produce false operation during the interval when the phototube is dark.

If the relay is to be operated by some translucent material entering the light beam which provides a light attenuation of at least 50 percent with the beam completely intercepted, then this material should be used instead of an opaque object for making the light level adjustments as described previously. The relay should be adjusted for operation with the material covering about 50 to 70 percent of the lens or phototube opening. Operation with material which partially attenuates the light requires better line voltage regulation than operation with complete light cutoff.

Maintenance

Maintenance of the photoelectric relay is limited primarily to keeping the lenses, phototubes, and phototube circuits clean; occasional inspection of the relay adjustment; adjustment and replacement, when necessary, of contact tips of the magnetic relay; and routine testing of the amplifier tubes and replacing when necessary.

The frequency with which lenses and phototubes, if exposed, have to be cleaned depends entirely upon the conditions in which the equipment is located (Fig. 3.). The discussion on lens cleaning for light sources applies to the photoelectric relay as well. All cables and connections in the phototube circuit must be kept clean and dry. As



Plenty of room up there,

but will the roof stand the weight?

Ducts, dust collectors, humidifiers, fans and motors—add air conditioning as a means of meeting postwar competition, and you need them all. The roof is a fine spot for such equipment. It's out of the way, easy to get at for servicing, but there's this question—

Will the roof stand the burden of heavy equipment?

Lightweight aluminum will help meet that objection. Use it generously and reduce the loads roof trusses have to carry. Aluminum ducts distributing conditioned air throughout your plant place less burden on their supports. The lightness of aluminum makes handling and erection easier.

The corrosion-resisting ability of aluminum lengthens the life of all this equipment. Less attention for maintenance is required. Where humidities are high, there is no rusting to cause staining from condensation and dripping.

Manufacturers of air conditioning equipment have had a wealth of experience in working with aluminum both before and during the war. Its use introduces no unusual fabricating problems. ALUMINUM COMPANY OF AMERICA, 1946 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM



You buy only 3 BUSHINGS instead of 3 BOXES—

for *all* connections

Think of the saving you can make in stock-room space—and conduit fitting inventory!

With these 3 small bushings (interchangeable at any outlet of any Kondu fitting) you can make either a *Threaded* or *Threadless* connection, to Thin-Wall or Thick-Wall conduit.



Lifts out of the line without disturbing conduit

Only with a Kondu fitting can you take out one box and put in another, without disturbing conduit. Every Kondu box is a union in itself.

Find out all about Kondu . . . Quickest to Install, but Vibration-Proof. 100% re-usable. Write for catalog.

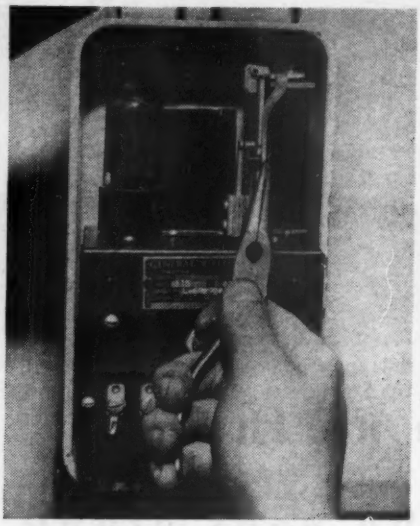
KONDU CORPORATION, Erie, Pa.

Kondu Mfg. Co. Ltd., Preston, Ont.





LENSES AND OTHER PARTS of the optical system should be wiped regularly with a clean, soft cloth. (Figure 3)



ARMATURE STOP of telephone-type relay being adjusted in order to permit contacts to receive full spring pressure. (Figure 4)

mentioned previously, this portion of the circuit operates at very high impedance, and therefore precautions must be taken to prevent its exposure to excessive moisture. If appreciable dust collects in the enclosure, an occasional cleaning with an air hose will be beneficial.

Since there will be a gradual decrease in light due to darkening of the lamp bulb, and some change in both phototube and amplifier tube characteristic, it is advisable to check the relay adjustment occasionally.

Since photoelectric relays are quite often operated up to 400 times a minute, very severe duty can be imposed on the telephone relay or contactor. In fact, under such operating conditions 24 hours a day, many million operations can be obtained in a few weeks' service. For this reason, the relay or contactor should be inspected frequently and suitable repairs, adjustments, or replacements made whenever necessary.

In devices using the telephone relay it is advisable to inspect occasionally the normally closed contacts to determine whether full spring pressure is being applied to the contact tips. In some cases, the wear of the contacts may increase to the point where the armature stop prevents the contacts from receiving full spring pressure. This may be remedied by bending the armature stop to provide $\frac{1}{16}$ in. clearance between the armature arm and the contact spring (Fig. 4).

In order to maintain continuous service, a definite schedule should be followed in the testing of tubes. The radio receiving type tubes can be checked in a conventional tube-tester used by radio dealers. A routine check about every three to six months and the discarding of any tubes which read low should provide practically trouble-free operation. Occasionally a tube may be found which fails to work in a photoelectric relay, but indicates "good" on the tester. This occurs because the ordinary radio tube-tester does not check for all the characteristics used by the electronic circuit. Power output type tubes such as the *25L6, 6L6, 6V6, 117N7GT, or 117P7GT, may exhibit this effect.*

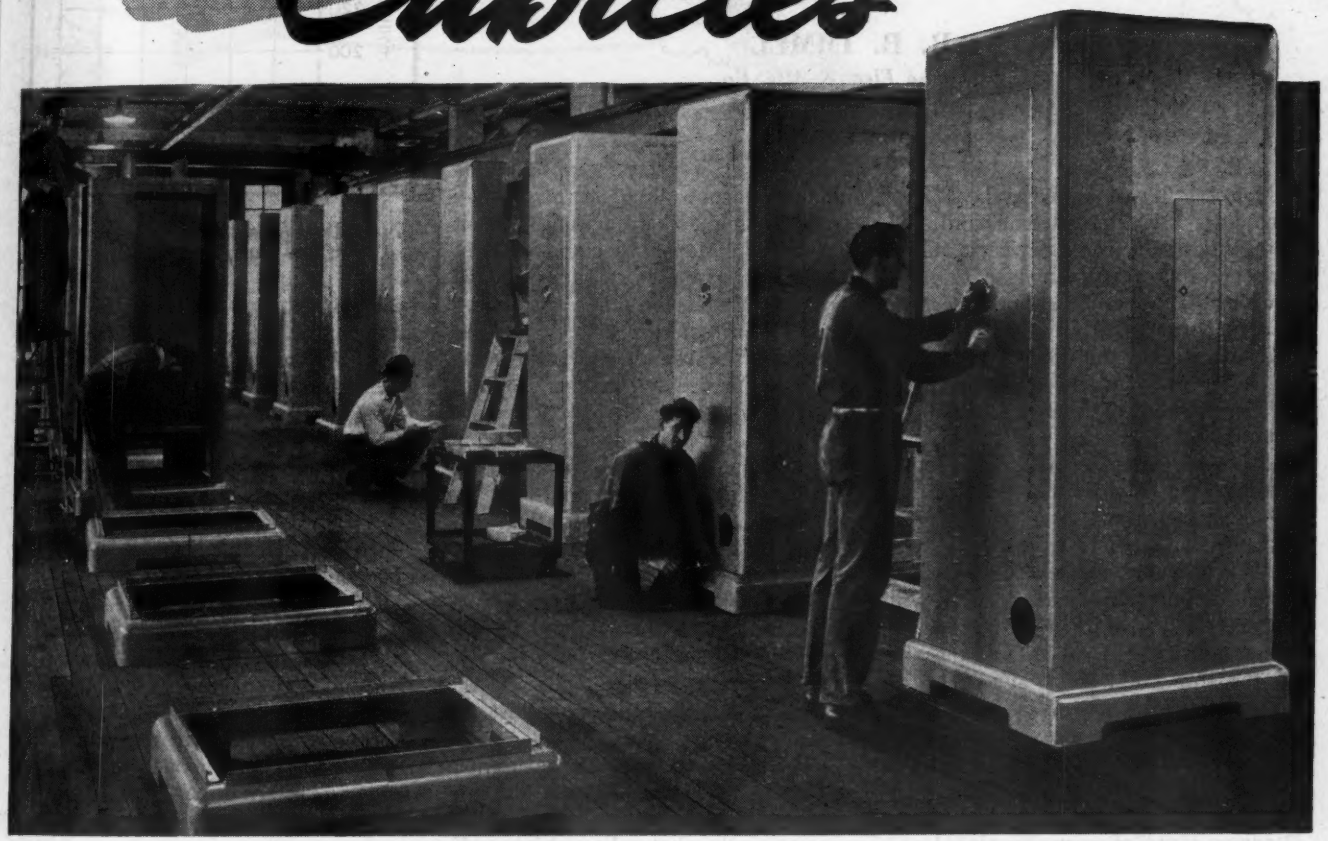
Due to the present war restrictions there have been a great many cases where the metal form of the radio tube has been limited to government use or discontinued, and its glass equivalent substituted. In general, the glass form will be satisfactory providing there is sufficient space to take the larger tube. This form is usually designated by the suffix "GT" or "G".

At the present time there is no conventional means for readily testing phototubes. However, when used in proper circuits and not abused by excessive light of high ambient temperature, these tubes will have a life expectancy of more than a year and quite commonly last two or three years.



***MEMPHIS CONTRACTORS** Milton Byrd (left) and R. E. Feltus display the brand of sociability, at the recent T.E.C.A. meeting, for which the South is noted.*

KIRK AND BLUM Cubicles



The above illustration taken in our fabrication department shows a number of cubicles (in various stages of construction) that are part of a large rush order delivered on time.

for UTILITIES

Control and Distribution

Our Sheet Metal Fabrication Department is specially equipped to produce custom-built sheet metal equipment for the electrical industry—"tailored" to meet your exact specifications and fabricated on time.

Whatever your requirements for Cubicles, Control Desks, Switch Gear Housing, etc.—Kirk & Blum's 37 years of experience and modern expanded facilities are your guarantee of obtaining accurately made equipment at economical cost.

Kirk & Blum facilities, efficiency, and quality standards are held in high esteem by electrical engineers the nation over. That fact is well proved by the widespread use of control equipment fabricated and installed by us.

For 100% satisfaction and no regrets send us your blue prints for prompt quotations.

Accurate Sheet Metal Fabrication Capacity 3/8" or lighter

The KIRK & BLUM MANUFACTURING Co.

2864 Spring Grove Ave. **Cincinnati 25, Ohio**

Electronic Auxiliaries—5

Relays, current regulators, fuses and thermostatic flow-switches in electronic circuits.

By R. B. IMMEL
Westinghouse Elec. & Mfg. Co.
East Pittsburgh, Pa.

7. Relays

Magnetically operated relays and contactors are often used in conjunction with an electronic device to fulfill the operating requirements of a particular installation. Sometimes the current conducting capacity of some tubes is insufficient, or multiple contact closing or opening functions are required, or certain control sequences must be obtained.

A simple direct current relay consisting essentially of a magnetic frame, a moving armature, a coil, and a contact mechanism is illustrated by Fig. 23. When the magnet coil is energized, the magnetic field produced will attract the armature and cause it to move toward and seal against the end of the iron core. The lower end of the armature serves as a bearing or hinge joint. For the relay shown, the moving contact will bridge the two stationary contacts and complete the circuit when the armature closes. Various types of normally closed and normally open contact mechanisms can be adapted to and operated by this type of magnet. A sheet of nonmagnetic material is often assembled on the armature for a shim so that there is a gap in the magnetic circuit. This is essential as the residual magnetism in a completely closed iron magnetic circuit is sometimes sufficient to hold the armature closed even though the coil is deenergized.

This magnetically operated contactor is known as a relay because of its function of controlling or relaying an electrical impulse from one circuit to another. Many types and sizes of relays are available with coils and magnets suitable for other alternating current or direct current service.

Magnets for use on alternating current circuits usually have a shading-coil (a short-circuited low resistance loop or coil) imbedded in and encircling a portion of the pole face to provide a magnetic holding force at the instant when the alternating current is at a zero value. The shading coil action is similar to transformer action and the current in the coil is out of phase with the magnet coil current; the magnetic force from the two coils, therefore, is continuous and the armature is held securely against the core.

Relays of this type can be used in conjunction with a phototube and amplifier to control external circuit load current, as the phototube and its amplifier circuit are usually suitable for only a few microamperes or milliamperes output. The electronic tube and circuit output are, however, sufficient for operating the sensitive relay.

8. Ballast or Current Regulator Tube

Regulator tubes are available for absorbing the supply voltage variations in a circuit where a device must be operated at substantially constant current. This regulating action is accomplished by the variable resistance characteristic of the filament in a ballast or current regulator tube. The filament resistance changes rapidly with its temperature and thus tends to keep the same current flowing through it regardless of the fluctuations in the line voltage.

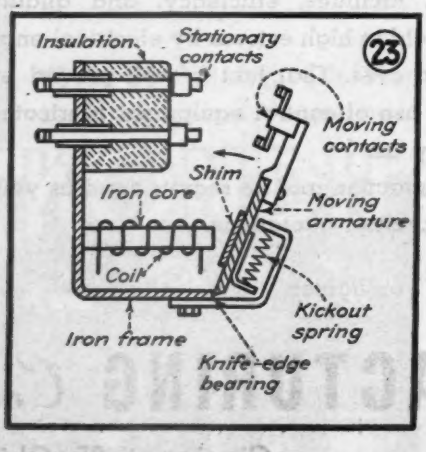


FIG. 23. Magnetic d.c. relay.

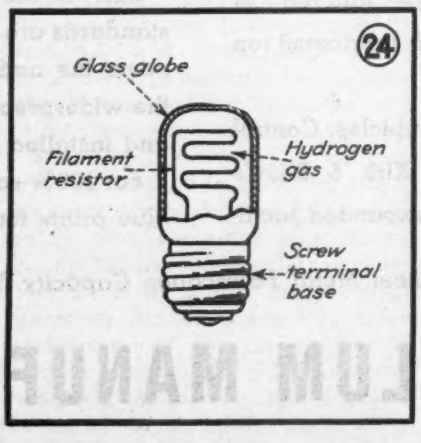


FIG. 24. Current regulator tube.

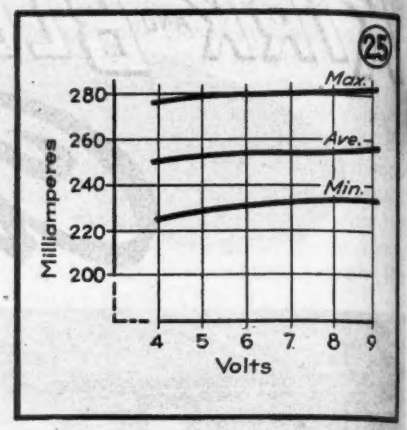


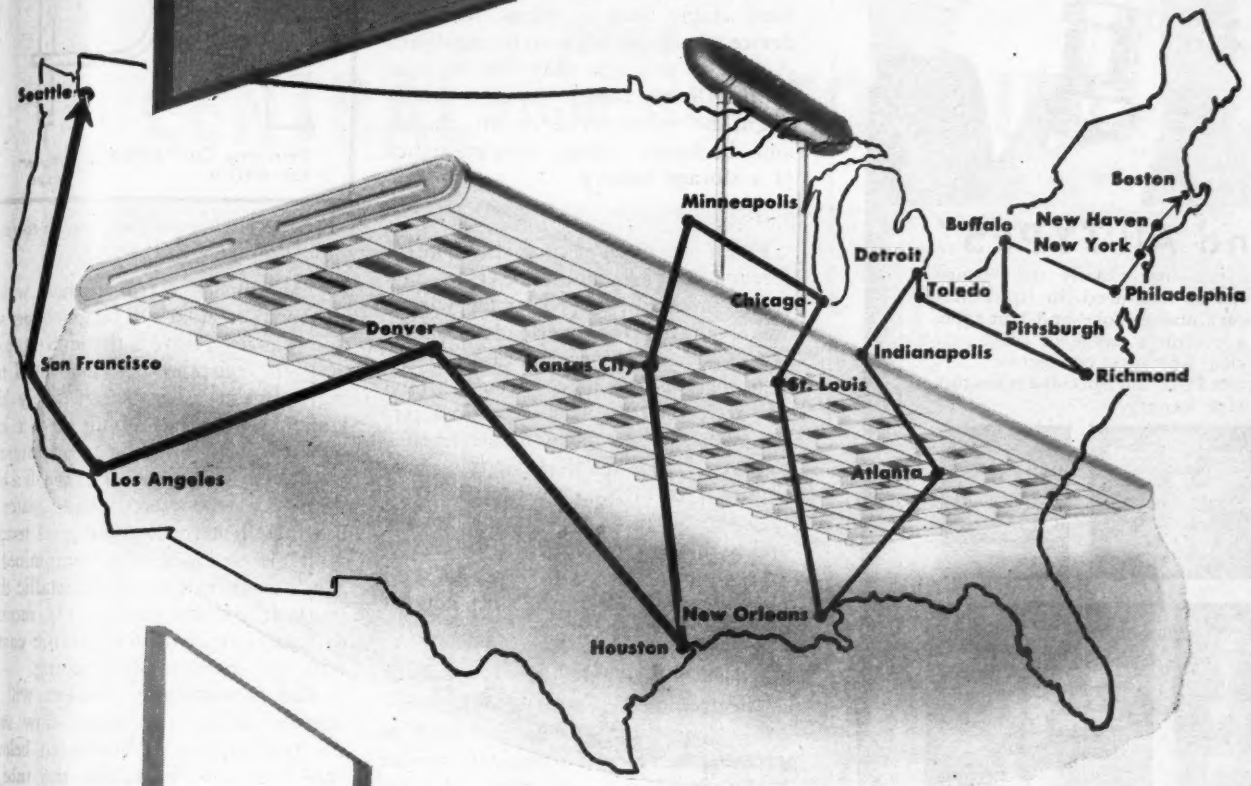
FIG. 25. Volt-ampere characteristics of a typical current regulator tube.

A typical regulator tube consists essentially of a filament mounted in a glass bulb or tube containing a gas at a low pressure as illustrated by Fig. 24. The only function of the gas is to conduct heat from the filament to the bulb and subsequently to the surrounding air. A typical filament may be constructed of iron wire which has a relatively large temperature coefficient of resistance. A small change in the current passing through the filament can effect a very large change in the temperature and subsequent resistance of the filament. If the supply voltage should increase, the tube will automatically increase its resistance by an amount sufficient to absorb a large portion of the increase in voltage and maintain the current at an approximately constant value. A decrease in supply voltage will effect an opposite change and a reduced value of filament resistance will tend to hold the current value constant. The very rapid cooling effect of the gas which is often hydrogen helps to conduct heat from the filament to the bulb and to extend the regulating characteristic range.

While this device is known as a regulator tube, it cannot be classified as an electronic tube as its operation is a thermal and not an electronic function.

A typical characteristic operating curve for a hydrogen filled tube is shown by Fig. 25. Tubes are designed for a definite voltage range and for controlling currents between specific limits. Typical hydrogen filled tubes are manufactured for a current range of 225 to 275 milliamperes at a voltage

A Leader FROM COAST TO COAST



★ ***Sound and realistic engineering.*** Leader Engineers are steadily working toward scientifically improved lighting.

★ ***Careful manufacturing*** in a modern plant using up-to-date equipment and principles.

★ ***Mass production*** of a complete high quality line of fluorescent fixtures at a cost range within everyone's reach.

★ ***These Leader factors*** combined with high quality standards have brought Leader to the front. Leader is recommended and distributed nationally.

CONTACT YOUR NEAREST LEADER REPRESENTATIVE

New Orleans	Richmond	St. Louis	Los Angeles	Pittsburgh
Boston	Atlanta	Kansas City	Minneapolis	Toledo
New Haven	Detroit	Denver	Buffalo	Indianapolis
New York	Chicago	Seattle	Philadelphia	Houston
		San Francisco		



"A STEP AHEAD" LEADER ELECTRIC MFG. CORP

★ *Distributed only through the Better Electrical Wholesalers*

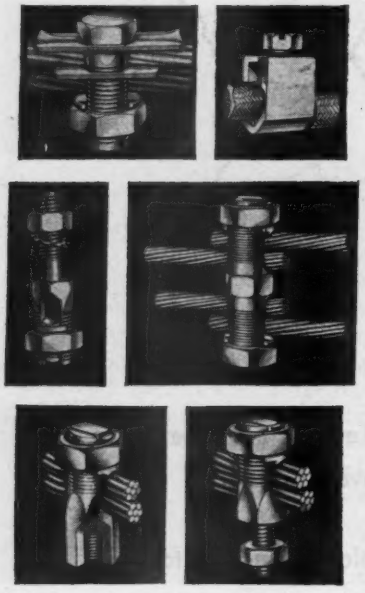
"All SIZES of SERVICE CONNECTORS—

from No. 10 to 1,000,000



and All TYPES"

You can find exactly the service connector you need, in the Penn-Union Catalog: Yoke-and-Nut type, in a complete range of sizes . . . Service Entrance connectors . . . Service Post and Special connectors in wide variety.



Also . . . the most complete line of Tee Connectors, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs . . . practically every good type.

Leading utilities, industrials, electrical manufacturers and contractors have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for the Penn-Union Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

range of 5 to 8, 9 to 18, or 20 to 30 volts.

These tubes are often employed to maintain essentially constant voltage on (or constant current through) the filaments or heaters of electronic tubes with which they may be connected in series. The tubes are often frequently used singly and in series with the device whose current is to be regulated. A tube of this type may also be used to absorb the voltage changes which might be encountered in the charge and discharge voltage characteristics of a storage battery.

9. *Fuse*

Fuses are often used in the control circuits of an industrial electronic device or circuit to protect the wiring and apparatus from overloads or short-circuit currents. A typical fuse consists of a current responsive element which will melt when it is subjected to a certain overload current for a specific time period. It has an inverse time characteristic of melting to open a circuit in a short time if the current is large and to operate in a longer time on less severe currents. A fuse may be used in either alternating or direct current circuits.

10. *Electro-Thermostatic Flow Switch*

Electronic tubes, such as an ignitron, are often water or liquid cooled to provide a more economical use of materials and a minimum physical size. However, the successful operation of a liquid cooled tube depends upon a continuous and sufficient flow of the cooling medium through the cooling jacket of the tube. Any stoppage of the water or cooling fluid, even for a short time, may cause the tube to be overheated and permanently damaged.

The electro-thermostatic flow switch is a device for protecting a tube from cooling water failure and for functioning to provide a warning or an automatic action to make the tube inoperative until the proper cooling is re-established.

The flow switch illustrated by Fig.

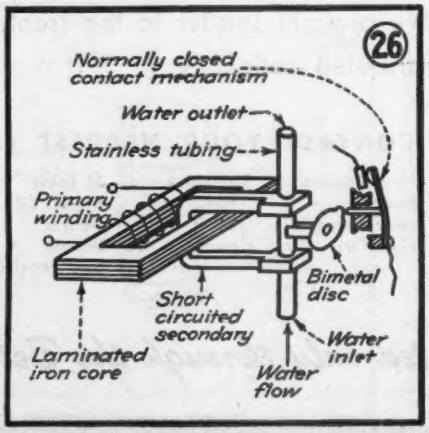


FIG. 26. Electro-thermostatic flow switch

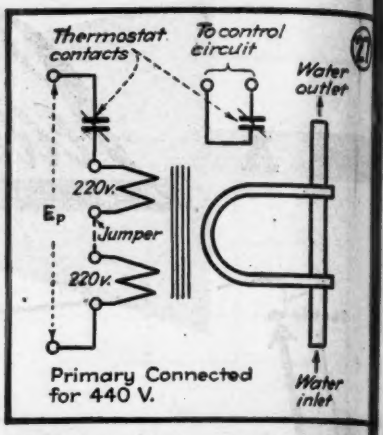


FIG. 27. Diagram for electro-thermostatic flow switch

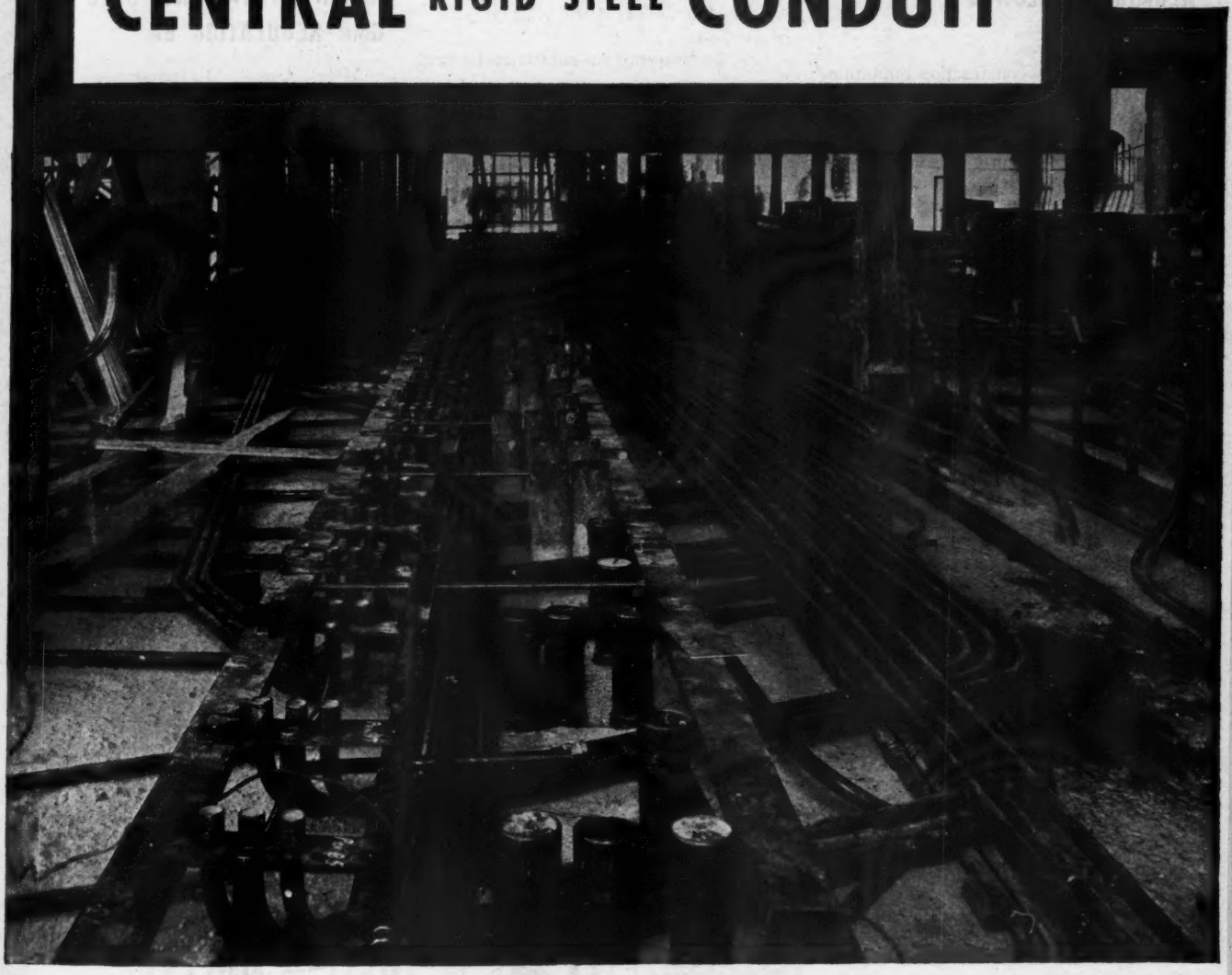
26 consists of a transformer with one-turn secondary of large copper section short-circuited through a piece of high resistance stainless steel tubing. Because of the relatively high resistance of the tubing and a high secondary current, the temperature of any given tubing area will reach a high degree. However, when water is flowing through the tubing its temperature is reduced and maintained at a moderate value. A bimetallic thermostatic switch element is mounted so that it is in direct metallic contact with the stainless steel tubing.

The thermostatic element will not operate unless the water flow stops or the rate of flow is decreased below a safe minimum value for the tube, or the water from the electronic tube reaches an excessive temperature. The temperature of the stainless steel tubing depends directly upon the rate of water flow and the inlet water temperature. (The transformer input wattage and the resistance of the tubing are constant.)

This type of flow switch is superior to a mechanical type of flow switch since it can automatically compensate for low rate of water flow and low inlet water temperature or for a high rate of water flow and a high inlet water temperature. Also, the straight through water flow in the tubing minimizes the clogging of pipes and parts.

Fig. 27. shows a typical diagram for the electro-thermostatic flow switch. A two winding primary is usually used on the primary of the transformer so that it may be used on several supply voltages. The windings can be connected in series for one line voltage or in parallel for one half of that higher line voltage. The thermostatic element may have two normally closed contacts. One set of contacts may be used in the control circuit and the other may be used to disconnect the transformer primary to prevent excessive heating of the transformer during a water failure.

Engineering Know How
plus
CENTRAL RIGID STEEL CONDUIT



"There's Tested Strength in Every Length"



SPANG-CHALFANT

Division of The National Supply Company

Executive Offices: Grant Building, Pittsburgh, Pa.

District Offices and Sales Representatives in Principal Cities

IN THE NEWS

ALUMINUM ALLOWED FOR BUSBARS

Modifications in construction limitations to reflect recent changes in War Production Board orders governing the construction industry have been made in Schedule A to CMP Regulation 6 amended August 7. The modification includes permission to use aluminum for busbars, conductors and current carrying accessories.

The amendments are applicable to builders who have received authorizations on Form GA-1456 subject to the construction limitations dated February 1, 1944, and Schedule A to CMP Regulation 6 of May 23, 1944.

When a restriction on the use of an item is changed or removed by an amendment to the general construction limitations list issued after an authorization has been received, the builder may disregard the previous restriction and follow the new provision without obtaining specific authority.

Changes in restrictions on the use of lumber, aluminum, copper, tin and zinc are made in the new construction limitations to line up with controlling L (Limitation) and M (Conservation) orders.

The regulations pertaining to electric work are—

N. *Electrical Work.* 1. The use of electrical wire and cable in sizes larger than the minimum size permitted by the 1940 National Electrical Code as amended is prohibited.

2. The use of rigid metallic conduit is prohibited except for the minimum sizes permitted by the 1940 National Electrical Code as amended and then only:

a. In any size when the installation is in a hazardous location as defined by the 1940 National Electrical Code, Classes 1 to 4 inclusive.

b. In sizes over 2 inches.

(1) For safety purposes as protection against mechanical injury.

(2) In wet locations as defined in Article 100 of the 1940 National Electrical Code.

(3) Where electrical conductors are to be enclosed within concrete or masonry.

c. In sizes 2 inches and under to suspend an industrial lighting fixture.

3. The use of electrical metallic tubing is prohibited except for the minimum sizes permitted by the 1940 National Electrical Code as amended and then only:

(a) For safety purposes as protection against mechanical injury.

(b) Where electrical conductors are to be enclosed within concrete or masonry.

(c) When run in elevator hoistways for elevator power, control and signal wiring.

(d) In wet locations as defined in Article 100 of the 1940 National Electrical Code.

(e) To suspend an industrial lighting fixture.

4. The use of flexible metallic conduit or tubing is prohibited except for the minimum sizes permitted by the 1940 National Electrical Code as amended and then only:

a. To provide a flexible enclosure for:

(1) Electric wire or cable which is a component part of a machine.

(2) Electric wire or cable extending less than twelve feet from electrical systems to current consuming devices or control equipment.

5. Armored cable (BX cable) may be used only for:

(a) Uses permitted for flexible metallic conduit in Item N-4.

(b) Remodeling and conversion of fireproof structures.

(c) Control systems in connection with boilers.

6. Exterior lighting is prohibited except when mounted on buildings.

O. *Standby and emergency equipment.* Standby equipment is prohibited.

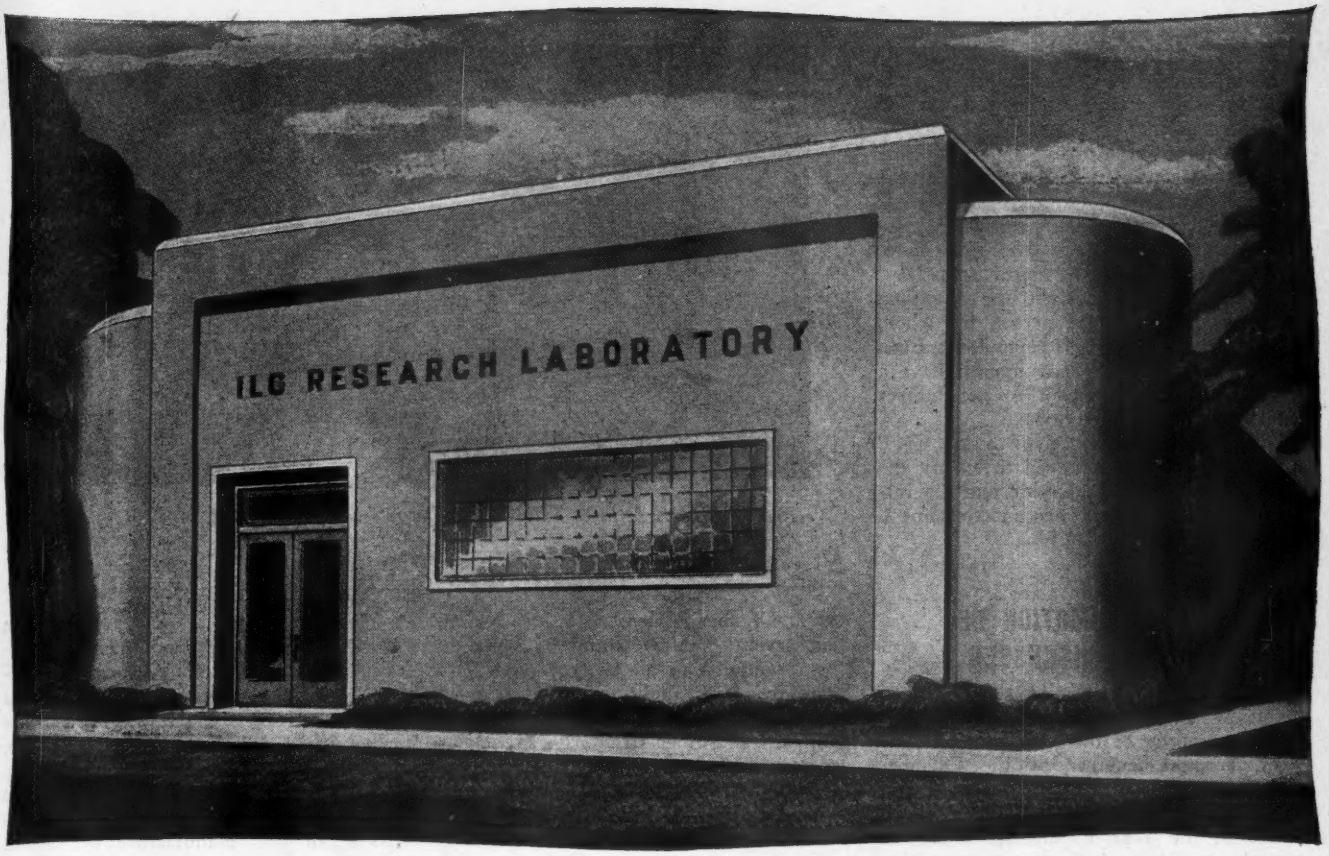
INTERPRETATION NO. 3 TO CMP REGULATION 9A

After August 1, repairmen placing orders for lumber required on construction jobs must be certified either as agents for persons employing them or have such persons certify their lumber orders according to the War Production Board.

WPB officials said that a contractor doing construction for another person is not considered the consumer of the lumber that he uses. The person for whom the construction is being done is considered to be the consumer and therefore is entitled to place the certification on the lumber order, it was explained. This provision also applies to a repairman who does construction work for another person, officials continued. Construction means the putting up, altering or repairing of any sort of a structure including a building, road, bridge, dam, sewer and similar jobs. It also includes the installation of equipment or fixtures in such a structure. A consumer may authorize the contractor or repairman to act as his agent in certifying a lumber delivery



"Isn't it rather a large transformer just for a door bell, Miss Perkins?"





ILG OPENS NEW RESEARCH LABORATORY

DEVOTED TO THE SCIENTIFIC STUDY OF AIR

Expanded research facilities, free from production noise and vibration of the main plant, have now been provided in a recently completed, sound-deadened, shake-proof building housing the new ILG Research Laboratory. Equipped with all latest developments in laboratory instruments for measuring air, electricity, sound, light and vibration, including stroboscopic apparatus... separate motor-generators to develop all commercially available types of current... its own boiler plant to provide steam and hot water for unit heater experiments, to stimulate day and night, year 'round research. And the expert staff has been completely divorced from production responsibilities to concentrate on scientific developments. You are urged to visit this new home of research... to use its complete and modern facilities in solving problems you may encounter in the conditioning and handling of air.

ARMY E NAVY

ILG **VITALIZED VENTILATION**

AND AIR CONDITIONING



YOU ARE INVITED TO SEND FOR THIS FREE BROCHURE

Fully illustrated booklet pictures the plan, the building, the staff, the wide range of equipment in new ILG Research Laboratory. Phone nearby Branch Office (consult classified directory) or send coupon for your copy today.

ILG ELECTRIC VENTILATING CO., CHICAGO 41

2841 NORTH CRAWFORD AVENUE, OFFICES IN 38 PRINCIPAL CITIES

☐ Send free copy of new brochure on ILG Research Laboratory

Firm Name_____

Individual _____ Title_____

Street_____ Zone_____

City_____ State_____

order. In such a case, the contractor or the repairman signs the required certification "as the duly authorized official" of the consumer.

The term "repairman" applies to carpenters, electricians, radio repair shops, plumbers, refrigeration repair shops, boiler repair shops, motor rewinders, electrical contractors, automotive repair shops, upholstery and bicycle repair shops.

The contractor does not use his rating, but the rating of the person for whom the construction work is being done. Even though a repairman may himself have a rating he cannot use it to get lumber for that construction job.

This interpretation No. 3 to CMP Regulation 9A was issued to clarify the use of Maintenance, Repair and Operating Supplies by repairmen and consumers.



MAGNIFLUX INSPECTION technique is demonstrated by K. E. Glover, Magniflux Corp., at inspection lighting clinic sponsored by the Chicago Lighting Institute for war plant material inspectors.

NEED FOR RESUMPTION OF CONSTRUCTION DISCUSSED WITH NELSON

A committee of the construction industry, brought together by the Chamber of Commerce of the United States, met recently with Donald M. Nelson, chairman of the War Production Board, to emphasize the need of prompt resumption of construction as labor and materials become increasingly available.

The construction industry, the committee pointed out, realizes its responsibility as one of the first industries which must get started to sustain employment as war work eases off.

The industry committee, which included representatives of building materials and equipment manufacturers and suppliers, as well as engineers, architects, contractors and home builders, told Mr. Nelson that several months would be saved in the resumption of all types of construction work if the industry could be given assurance that necessary equipment for buildings and other structures, as well as building materials, could be produced and permitted to flow through industry channels as rapidly as war needs permit.

Since the pipe lines of building equipment are nearly empty, it will be essential, the committee declared, to start filling them at the earliest practicable time, to give encouragement to the start of construction work.

Positive stimulation will be needed to get construction work in process, the group told Mr. Nelson. It expressed its conviction that major reliance should be placed on the industry and upon construction users to decide which work should be started first. The committee pointed out that where projects are ready to start and where men and materials become available, priorities assistance and other necessary encouragement should be given to enable the work to get under way promptly. Such a procedure, the committee said, would require a minimum of regulation or direction from Washington. If combined with the provision for the manufacture of needed equipment, the committee held it would insure a morale-building increase in civilian jobs during the transition period.

Mr. Nelson assured the committee that WPB would take steps to insure a speedy start for the construction sector of the country's economy.



WELDING FEEDER DESIGN was discussed at the A.I.E.E. summer technical session in St. Louis by (L to R) A. C. Johnson (E. G. Budd Co.) L. W. Clark (Detroit Edison Co.), and Dr. C. A. Adams (E. G. Budd Co.), with emphasis on the determination of probable maximum equivalent continuous welding current.

J. C. FORSYTH

Joseph C. Forsyth, for over 51 years Chief Electrical Inspector, Supervising Engineer and Consultant of the Electrical Bureau of the New York Board of Fire Underwriters, passed away on August 18. He was 84 years old.

Mr. Forsyth, known throughout this country as the Dean of Electrical Inspectors, was for years president of the Eastern Association of Electrical Inspectors and became the first president of the International Association of Electrical Inspectors.

Mr. Forsyth was formerly a member of the Electrical Committee of the NFPA and had been instrumental in the promulgation of the National Electrical Code since its inception.

HOUSEHOLD METER BOXES MAY BE REMOVED FROM ORDER M-126

To meet demands of public utility companies and the Rural Electrification Administration for household meter boxes, the Knife and Enclosed Electric Switch Industry Advisory Committee recently recommended that such boxes be removed from Order M-126, which prohibits their manufacture, the War Production Board has reported.

the little man who's always there





A roll of Security Friction Tape in the tool box or on the work bench is just as good as having a "Johnny-fix-it" around to splice electric wire and make emergency repairs. "Security" is always ready to "take hold" on construction or assembly jobs involving electrical connections, or to turn to wherever there's an emergency need.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

US — UNITED STATES RUBBER COMPANY — TRADE MARK

SERVING THROUGH SCIENCE

SAFUSWITCH



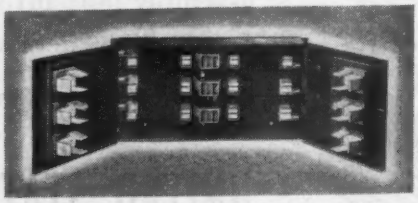
SHOCKPROOF because all live parts are killed automatically in unit as door to fuses is opened

You can't get a shock, even if you try, while changing fuses in a Kinney "Safuswitch" Feeder Distribution Panel.

For opening the door of any "Safuswitch" unit to get at the fuses disconnects that entire circuit from the panel's bus system. Fuses and all current carrying parts remain dead so long as the unit door is open. No live parts can cause accidents, even through carelessness.

Give your plant the benefits of "Safuswitch" protection. These safer switch-and-fuse panels are available for 250 and 575-volt services and in branch capacities ranging from 30 to 600 amperes.

- **Units have removable enclosures with asbestos insulating bases.**
- **All poles break together, no single-phasing possible.**
- **Safe, dead-front construction.**



OPEN VIEW OF "SAFUSWITCH" UNIT

KINNEY

PANELBOARDS SWITCHBOARDS

KINNEY ELECTRICAL MFG. COMPANY • 2900 CARROLL AVENUE • CHICAGO 12, ILLINOIS

Also it was suggested that WPB consider permitting the fabrication of combination electric meter enclosures and service entrance equipment, such manufacture is now prohibited by Order L-31

During the committee's discussions, it was pointed out that WPB's General Industrial Equipment Division has received complaints about the inadequacy of the AA-4 preference rating assigned to distributors for obtaining knife and enclosed electric switches on Form WPB-54 WPB's Wholesale and Retail Trade Division explained that it will allow distributors a 60-day inventory of safety switches on the AA-4 rating. However committee members called attention to the fact that only part of the manufacturers are able to supply switches on this rating

Committee members were informed that Navy requirements for switches will probably be fairly constant for the next four quarters since increases on advance base requirements are not considered likely.

LIMITED HOUSING CONSTRUCTION AUTHORIZED

A limited program of housing construction to relieve housing shortages for resident war workers in congested war production areas was announced jointly recently by the War Production Board and the National Housing Agency.

Construction under the new program, to be designated as H-2 housing, will be in addition to housing construction now under way to meet the needs of essential in-migrant war workers. New starts under the in-migrant program, designated as H-1 housing, are declining in reflection of the increasing stabilization of war employment in many production areas and the consequent decrease in net in-migration of war labor.

Current tentative forecasts indicate the starting of several thousand dwelling units under the new program during the



OFFICERS of the Chicago Technical Societies Council, an affiliation of scientific, technical and engineering societies in Metropolitan Chicago are (seated L to R) treasurer, G. P. Halliwell, American Institute of Mining & Metallurgical Engineers; president, T. S. McEwan, American Society of Mechanical Engineers; vice-president, B. E. Schaar, American Chemical Society; (standing L to R) recording secretary, Paul S. Smith, Institute of Radio Engineers; and corresponding secretary, K. H. Hobbie, American Society for Metals.



A LEADING COSMETICS MANUFACTURER REPORTS:

"We cut down the size of our gift boxes and standard packages to effect an over-all saving of approximately 25% of the paper and cardboard; standardized our window displays and eliminated all die-cuts, as well as steps, shelves and secondary planes. We also folded all displays in half to save more than 50% of the paper and paperboard normally used."

A BIG PLATE GLASS COMPANY REPORTS:

"Our 1944 Color Book was reduced in size and quantity, resulting in a paper saving of 136,000 pounds. Our Color Cards, of which four or five million are used annually, were reduced in size at an approximate reduction of 50% in paper tonnage. We have eliminated our Dealer Sales Portfolio. Our Color Book has become a 'self mailer,' eliminating need for envelopes."

Mr. Manufacturer,

CAN YOU TOP THESE?

The quotations used in this advertisement are from responses to the A. N. A. Committee of Paper Saving.

ONE OF THE TOP LIFE INSURANCE COMPANIES REPORTS:

"In 1944 we will continue to specify lighter weights of paper wherever possible and take all possible steps further to reduce paper tonnage. We are instructing our field offices to scrutinize carefully all requests for printed material and to disapprove all requests for quantities that appear excessive."



A FAMOUS ADDING MACHINE COMPANY REPORTS:

"In advertising and promotion we are using about 30% of the amount of printing and paper used in 1941 — that represents about 2/3 saving. However, further savings will be effected whenever possible this year as last."

Remember—

PAPER IS WAR POWER



USE LESS—SAVE ALL WASTE PAPER!

This advertisement contributed by this publication and prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information.

CHAMPION PERFORMANCE

Consistently among the leaders in the lamp industry for 44 years Champion **Incandescent**, and now *Fluorescent* Lamps are true "four letter champs" for industrial installations and replacements:

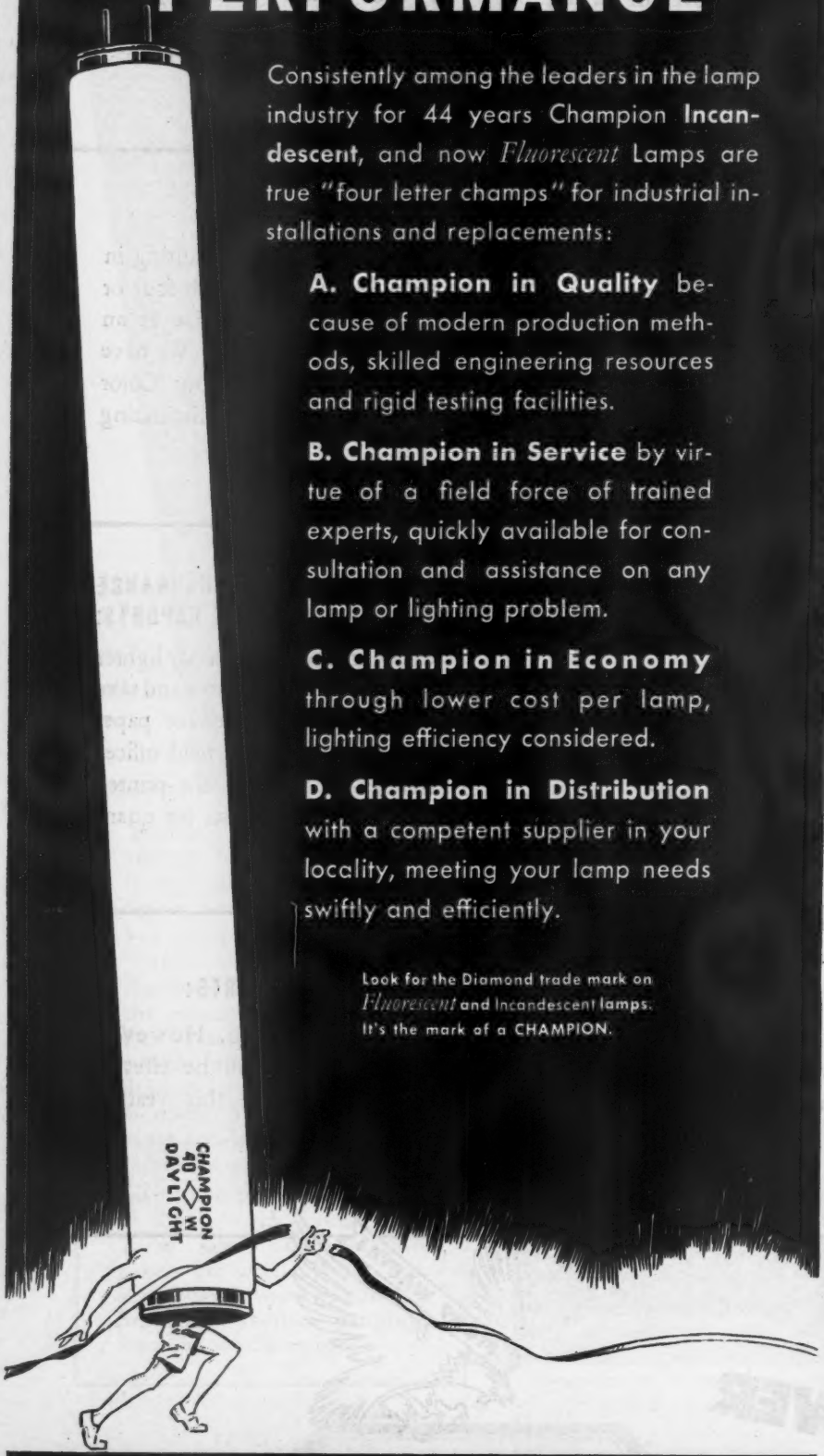
A. Champion in Quality because of modern production methods, skilled engineering resources and rigid testing facilities.

B. Champion in Service by virtue of a field force of trained experts, quickly available for consultation and assistance on any lamp or lighting problem.

C. Champion in Economy through lower cost per lamp, lighting efficiency considered.

D. Champion in Distribution with a competent supplier in your locality, meeting your lamp needs swiftly and efficiently.

Look for the Diamond trade mark on *Fluorescent* and Incandescent lamps. It's the mark of a CHAMPION.



CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

remainder of this year, with a probable quarterly volume of approximately 25,000 units during 1945. This would be in addition to housing started under the in-migrant program or to relieve cases of individual hardship.

Requests for materials for H-2 housing will be included in the NHA's regular quarterly requests filed with the WPB. Actual allocations of materials for H-2 housing by the WPB will be governed by the availability of the materials, and forecasts of construction volume under the new program are therefore subject to revision either upward or downward in line with developments in the war economy.

NISA CHAPTERS ELECT

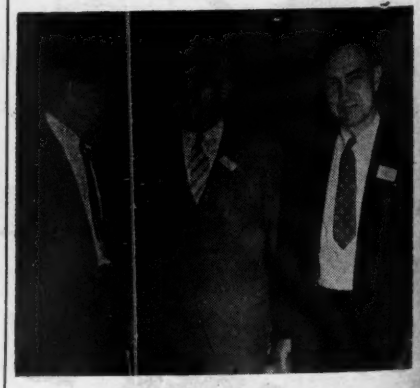
New officers were recently elected to guide the activities of two National Industrial Service Association Chapters on opposite coasts of the United States. The officials of the respective chapters are:

New England Chapter—president, A. L. "Andy" Brown, A. L. Brown Associates, Inc., Worcester, Mass.; vice-president, Fred S. Ferris, Northeastern Electric Co., Boston, Mass.; and secretary-treasurer, J. J. Reddington, J. J. Reddington Electric Service Company, Boston.

Bay Cities Chapter (California)—chairman, M. J. Lampurdi, North Bay Electrical Works, Inc., San Rafael, Calif.; vice-chairman, Wm. J. Boyd, Pacific Electric Motor Co., Oakland, Calif.; and secretary, Keith M. Noble, Pacific Electric Motor Company, Oakland.

NEW CONSTRUCTION MATERIALS DESIGN GUIDE AVAILABLE

A revised edition of the "Critical Construction Materials Design Guide" has been prepared to assist persons contemplating construction during wartime, was



***COOPERATIVE SPIRIT** between inspectors and contractors is typified by these Chattanoogans at the Memphis meeting of the Tennessee Electrical Contractors Association. (L to R) William L. Williams, chief electrical inspector; Philip Sweet, secretary-treasurer of the association; and Herbert Haile, W. C. Teas Co., and past president of the group.*



ELECTRICAL SAFETY in the City of Memphis, Tenn., is the responsibility of Harry L. Thomas, chief electrical inspector, who holds the respect and confidence of every electrical contractor in the city.

nnounced by the Conservation Division f the War Production Board.

This guide is an official supplement to Schedule A, Controlled Materials Plan Regulation 6 (Construction Limitations), WPB officials said, and stresses the ecessity of restricting construction deigns to those utilizing materials that are ost plentiful.

Intended for consultation by all persons pplying for permission to begin construcion on Form WPB-617, this supplement s neither a directive nor an order of the WPB, officials explained. Copies are vailable at all WPB regional and district ffices.

LIMITED NUMBER OF ELECTRIC RANGES PUT IN PRODUCTION

Production of 12,782 electric ranges in he third quarter of 1944 has been authorzed by the War Production Board to hree manufacturers who are able to make anges without interfering with war work. These manufacturers are the first ones



POSTWAR MARKETS discussed at recent N.C.E.I. conference in St. Paul, Minn., were of interest to (L. to R.) J. A. Busch and R. E. Steele of the promotional and lighting sales departments, Northern States Power Company, Minneapolis.

Record Breaking Orders
Prove Trade Acceptance
Lloyd
New *Automatic* Starter



In the New RED PLASTIC Can

Submitted to Underwriters' Laboratories Inc., for approval.

Submitted to Electrical Testing Laboratories, Inc., for certification.

Pat. Nos. 2200443 -2228210

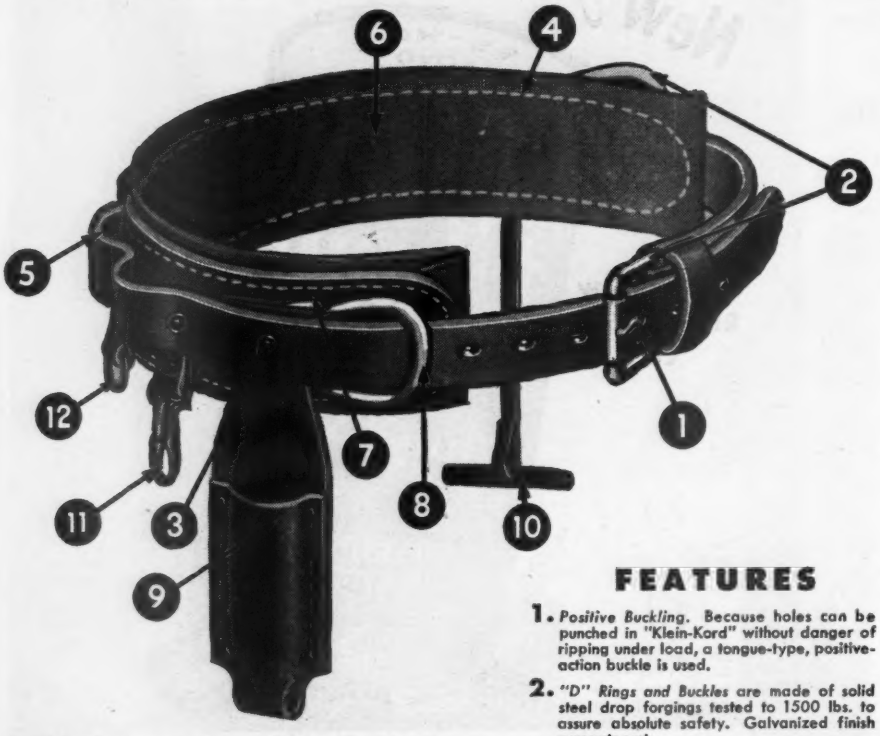
Locks Out...Resets AUTOMATICALLY

1. Positively cuts out deactivated, flickering blinking lamps.
2. When trouble is detected the starter automatically cuts off current to the ballast and lamp.
3. Gives long life to ballast because defective lamp is locked out. Prevents overheating.
4. When Lloyd AUTOMATIC locks out defective lamp —turn off the current—Remove defective lamp—Put in a new lamp.
   Allow at least one minute to make the above change of lamps. Turn on the current. The starter automatically lights the new lamp.
   NO NEED TO DO ANYTHING TO THE STARTER
5. Lloyd NEW PLASTIC CAN has higher dielectric strength, is stronger, lighter, distinctive.
6. Knurled rim on plastic can insures positive grip for insertion and removal of starter.
7. Plastic can is sealed. No projecting lugs to cause trouble.
8. The life of the AUTOMATIC starter is many times greater than that of the average lamp.
9. It saves maintenance costs and power consumption, protects and insures longer life to the ballast and lamp.
10. Tested in production and prior to shipment to insure perfect performance.

LLOYD PRODUCTS COMPANY
Dept. EC-9 Providence 5, N. Y.
Representatives in 23 leading cities
Export Office 13 E. 40th St., N.Y.C.

ANNOUNCING ... the NEW

"KLEIN-KORD" TOOL BELT



THE PROVED dependability of "Klein-Kord" Safety Straps has led to the development and introduction of the No. 5204-KK "Klein-Kord" Tool Belt.

Made from multi-ply, specially woven long staple cotton, with each ply laid in rubber and vulcanized, "Klein-Kord" is a strong, yet flexible, fabric that: (1) is of uniform quality; (2) resists absorption of moisture and detrimental effects of climate; and (3) does not stretch. It has a tensile strength many times that demanded in actual service.

You'll find that comfort, safety and efficient design—important to every lineman—are built-in features of this new "Klein-Kord" Tool Belt. All workmanship and materials are of the highest quality—quality that has been typical of the name Klein since 1857.

ASK YOUR SUPPLIER

FEATURES

1. *Positive Buckling.* Because holes can be punched in "Klein-Kord" without danger of ripping under load, a tongue-type, positive-action buckle is used.
2. *"D" Rings and Buckles* are made of solid steel drop forgings tested to 1500 lbs. to assure absolute safety. Galvanized finish prevents rust.
3. *Rivets.* All rivets are solid copper, hand set with burrs for added safety and strength.
4. *Sewing.* All sewing is done with hot waxed harness thread and lock stitched.
5. *Four Tool Loops,* conveniently located, are formed by the body strap.
6. *Canvas Lining, 4½ inches wide,* covers all rivets—an insulating feature that assures safety. Lining also absorbs body moisture to increase comfort of lineman.
7. *Metal Safety Clips,* riveted through main belt at "D" rings, prevent swing of "D" rings beyond 90 degrees from belt.
8. *Body Strap* passes through "D" rings for maximum safety.
9. *Plier Pocket* of "Klein-Kord".
10. *Tape Thong* with fibre cross bar.
11. *Knife Snap.*
12. *Handy Loop* for glove pouch.



This book on the care and safe use of tools will be sent on request.

Foreign Distributor: International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

Since 1857

authorized to participate in the recent announced program for the production of 88,000 electric ranges in 1944. The manufacturers are: A. B. Stoves, Inc., Battle Creek, Mich. Frigidaire Division, General Motors Corp., Dayton, Ohio, and Malleable Iron Range Co., Beaver Dam, Wis.

Of the 12,782 ranges, 1,500 are needed to fill "special" orders placed by the Army, Navy, Maritime Commission, War Shipping Administration, Federal Public Housing Authority, the Home Owners' Loan Corporation acting for the National Housing Administration, and export orders.

Manufacturers are required to build 7,560 ranges to fill orders for new privately-financed Federal Housing Administration war housing projects. The 3,720 electric ranges not needed to meet military and FHA requirements may be sold through retail stores for essential civilian replacement purposes. If it is found later that some of the ranges to be built by manufacturers for FHA housing projects are not needed for that purpose they also will be made available for retail sale to civilians, WPB officials said.

NEW LOAN POLICY FOR SMALL BUSINESS

After an investigation of the needs of small business during the contract termination period, the Board of Directors of the Smaller War Plants Corporation has announced a new loan policy that liberalizes regulations with respect to suspension of payments on principal and reduction in the rate of interest.

According to Maury Maverick, Chairman, Board of Directors, the new policy sets forth the following conditions:

1. Type of Loan: Loans must be made to provide working capital in connection with a war contract. Loans made to provide fixed assets or for other purposes will not be eligible.



MADISONITES E. N. Michelson (left), former chief electrical inspector of Madison, Wis., and now with Culver Electric Co. of the same city and O. M. Bradford, contractor, relax during session recess at recent NECA special meeting in St. Louis.



NGINEERS John Grotzinger (Goodyear Tire & Rubber Co., Akron), chairman, A.I.E.E. committee on industrial power applications and J. J. Orr (right), former chairman, look over the "Electrical Power Distribution for Industrial Plants" report presented at the summer technical session in St. Louis

2. Termination of Contract: The war contract, for the completion of which WPC supplied the working capital, must be terminated for the convenience of the Government. Contracts terminated because of the default of the borrower will not be eligible. In the event of partial termination of the war contract, the new policy will apply to a proportionate part of the loan.

EW ENGLAND NISA HAPTER REPORTS ACTIVE EETING PROGRAM

Monthly meetings of the New England Chapter of the National Industrial Service Association have shown consistently large attendance through the summer months according to J. J. Reddington, Chapter secretary-treasurer. At the June meeting thirteen members of the New York Chapter were guests. Arthur Turner, Tampa, Fla., president of NISA and Fred Wipperman, St. Louis, Mo., executive secretary, spoke.

In July the regular meeting was addressed by Roger B. Cabell of WPB and W. Little of OPA who outlined procedure under government regulations and explored possible areas of cooperation between the Chapter and their offices.

At a meeting scheduled for September Selden High of Cincinnati will talk on bookkeeping and accounting systems for the motor shop. The bookkeepers of the member shops will be invited to attend.

Officers of the Chapter are Alfred L. Brown, Alfred L. Brown Associates, Inc., Worcester, president; Fred S. Ferris, Northeastern Electric Co., Boston, vice-president; and J. J. Reddington, J. J. Reddington Electric Service Co., Boston, secretary-treasurer. Programs are under the direction of Mr. Ferris.



FOR ALL

Surface Wiring

USE

MONCOR

SURFACE

WIRING DEVICES

These good looking, sturdy surface wiring devices can be used anywhere —in military buildings, factories, farm buildings, war housing, etc. They are made of brown Textolite, keep their color and resist breakage.

Moncor Surface Wiring Devices can be installed quickly too, using either BraidX or BX. Knockouts in ends, side and back of the devices enable them to be end connected, side connected (knob and tube wiring) or back connected for concealed wiring.

All requirements on every surface wiring job with cables exposed or hidden are met by the devices. They are approved by the Underwriters' Laboratories, and they meet requirements of the specifications of different government agencies. For further information see the nearest G-E Merchandise Distributor or mail the coupon.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M EWT, CBS.

BUY WAR BONDS AND KEEP THEM

General Electric Company
Sec. D941-8, Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me information on Moncor Surface Wiring Devices.

Name.....

Address.....

City..... State.....

GENERAL ELECTRIC

for today and for tomorrow.....

QUAD

Lighting UNITS



RLM Heavy Threaded Deep Bowl Reflector and Socket Hoods

RLM Threaded Dome Reflector

OVER 53% of all jobs done by contractors involve the installation of lighting fixtures. Make your share of these jobs pay you by installing QUAD units. They are modern, easily wired and installed, quickly detachable for cleaning, and highly flexible in design. All units are weatherproof and porcelain finish is permanent. You install them and your job is finished—result is more time for more jobs. For the proper unit for general or specialized installations — indoor or out — make your selection from the very complete QUAD line.

QUADRANGLE MFG. COMPANY

Mfrs. of Incandescent and Fluorescent Lighting Equipment

32 SO. PEORIA ST. CHICAGO, ILL.

SAN FRANCISCO CONTRACTORS CLEARED OF CHARGES

Electrical contractors and unions in San Francisco Bay area, after more than four years under indictment for violation of the Sherman Anti-trust Act were exonerated August 30 when Judge Leon Yankwich of the Federal District Court granted a motion for dismissal. Judge Yankwich, an authority on anti-trust cases, had been transferred from Los Angeles to hear the case.

This action dismissed indictments against the San Francisco Electrical Contractors Association, Electrical Industry Depository of California, Electrical Contractors Association of Alameda and Contra Costa counties, International Brotherhood of Electrical Workers, Local Union No. 6 and Local Union No. 595, together with 39 individual contractors and union officials.

For three years, postponements had been asked by the government and during the last year postponements had been asked by the defendants due to war work. On August 1 this year the government insisted that the case go to trial immediately, and it did, on August 15.

During the presentation of evidence by the government, and in the judge's decision, the right of contractors to organize and establish rules of conduct on construction work was upheld. The flow of interstate commerce was not affected in this case it was found.

Upon motion of the defense for dismissal of the case, made right after the government presentation, the Judge granted the motion and the case never went to the jury, the Judge ruling that insufficient evidence had been presented.

As later pointed out by George W. Abbett, owner of the Abbett Electric Co., president of the San Francisco Electrical Contractors Association and secretary-treasurer of the Electrical Industry Depository of California, the defense represented by Faulkner & O'Connor, had been prepared with evidence.

ELECTRONICS COURSE TO BE GIVEN IN CHICAGO

Details of a second series of lectures on industrial electronics to be given in Chicago this fall have been announced by Arthur G. Mohaupt, director of industrial electronical engineering of Lee De Forest's Training, Inc., under whose auspices the lectures are to be presented.

Mr. Mohaupt's autumn course will consist of 12 lectures beginning September 6 and continuing to December 6. The course will be available to industrial executives, maintenance engineers, shop superintendents and electrical contractors.

Titles of the subjects to be covered are Electron Tube Fundamentals, Rectifier Systems, Thyratrons and Ignitrons, Electronic Measuring Instruments, Electronic Welding, Electronic Control of D.C. Motors, Photoelectric Cells, Electronic Elevator Controls, X-Rays and Industrial Applications, High Frequency Electronic Heating and Electronic Lighting Systems.

Electronic Welding will be presented in two successive lectures.

Each lecture will be illustrated with blackboard surveys and diagrams. Typical pieces of electronic apparatus loaned by leading radio and radar equipment manufacturers will be available for demonstration and individual study. These lesson aids will be supplemented with a series of bound notes, circuit diagrams and data charts which when assembled will comprise a veritable reference manual on industrial electronics.

NECA SAN DIEGO CHAPTER URGES COUNTY ORDINANCE

Passage of a county ordinance to regulate the installation of electrical work of all types in both the incorporated and unincorporated areas of San Diego County, Calif., was urged upon the Board of Supervisors of that County by the San Diego Chapter, National Electrical Contractors Assn., in a letter filed with the Board recently, by V. T. Heinz, secretary-treasurer of the chapter.

NISA STUDIES MOTOR REPAIR STANDARDS

Presentation of a comprehensive set of standards to guide the rebuilding of electrical equipment, at the NISA Cincinnati meeting last April by the Central District Chapter, NISA (Chicago) apparently unleashed a wave of enthusiasm on the part of NISA members for the development of National Motor Rebuilding Standards. The Chicago standards are now being closely studied by various chapters throughout the country as a basis for the proposed National Standards with a view to suggesting deletions, revisions and changes before adopting the provisions on a national basis.



PACIFIC NORTHWEST representatives from the state of Washington at recent NECA special meeting in St. Louis were Chapter managers R. D. Horning (left), Seattle; and Paul W. Heydon, Spokane.

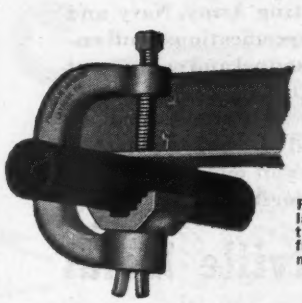
LATROBE PRODUCTS

FLOOR BOXES

WIRING SPECIALTIES

Latrobe Products are Easy to Install Safe and Long Lasting

Quality shows in better performance. Simplicity, in ease of installation. These advantages give special meaning to the time saving factor when Latrobe Products are based on industrial, commercial and residential jobs.



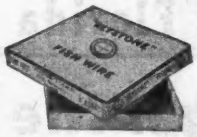
NO. 470 "BULL DOG" PIPE OR CONDUIT HANGER

Convenient and sure for hanging ½", ¾" and 1" pipe or conduit to steel beams up to ⅜" thick. Or for use as ground clamp.



"BULL DOG" INSULATOR SUPPORT

Fastens securely porcelain or glass insulators to exposed steel framework. No holes necessary.



KEYSTONE FISH WIRE

High quality — Rightly tempered — Ten different sizes — Various lengths.



NO. 280 NOZZLE

Shown here in No. 200 Cover Plate. Ten amp. 250 Volt receptacle. Brass housing on ½ in. brass pipe extension.



"BULL DOG" BX CABLE STAPLES

Supplied in any quantity —cartons, kegs and barrels.

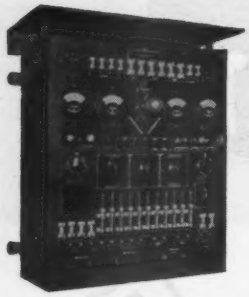


NO. 150 BOX NO. 207 NOZZLE

For installation in concrete floors or wood finished concrete floors.

QUALITY FULLMAN MANUFACTURING CO. LATROBE, PA. ALWAYS

Electrical Specialties
of Every Type
Including MARINE WORK



WORK TEST PANEL—built to customers' specifications and Navy standards.



RADIO MOTOR-GENERATOR and SELECTOR CONTROL PANEL—built to customers' specifications for any number of circuits.

JMM CO

ALL types of electrical specialties, boxes, cabinets, control panels, duct-work, etc., manufactured by an organization accustomed to meeting exacting Army, Navy and Commercial specifications. Full engineering personnel and equipment for manufacture of special electrical items to customers' needs in addition to all standard articles. Let us quote you on your requirements. Write for illustrated catalog.

Jacksonville Metal Manufacturing Company
247 Riverside Avenue
Jacksonville, Florida

You get the BEST in Time Switch Experience WITH BADGER

• This BADGER Synchronous Automatic Time Switch is specifically a heavy duty model with a capacity great enough to meet a wide variety of requirements. There is constant demand for these sturdily constructed time switches with more than thirty years of proven dependability to recommend them.

They are completely automatic and are furnished in single and double pole construction with indoor and outdoor cases.

You can guarantee accurate timing, economical operation, and years of dependable service for your customers. See your Wholesaler or send for catalog.

• *Prompt delivery on orders rated AA-5 or Higher.*

Type	Poles	Switch Capacity	Case
M1 (Synchronous)	1	50 A. at 125 V.	16 Ga. Steel
M2 "	2	50 A. at 125/250 V.	16 Ga. Steel
RM "	1	50 A. at 125 V.	Cast Iron
RM5 "	2	50 A. at 125/250 V.	Cast Iron

RELIANCE AUTOMATIC LIGHTING CO. RACINE WISCONSIN



SUPPLY PROBLEMS in the contracting field are discussed by (L to R) R. L. Carson, General Electric Co., Nashville; Jerry Cason, G. E. Supply Corp., Nashville and L. A. Ragon, Chattanooga contractor during a lobby session at the recent T.E.C.A. meeting in Memphis, Tennessee.

J. F. Ferrari, Excel Electric Service Co., Chicago, who chairmanned the local committee which drew up the Central District Standards, has been appointed the Chairman of the National Committee.

GERRY M. SANBORN

Gerry M. Sanborn, president of the Sanborn Electric Company, died suddenly at his home in Indianapolis on July 15 from a coronary attack.

Mr. Sanborn was very active in the National Electrical Contractors Association, serving as its fourth president. At the 42nd Annual Meeting of NECA in 1943, he was elected to honorary membership by unanimous vote of the Association.

In 1935, Mr. Sanborn received the James H. McGraw Award Contractors Medal, "for his contribution to the National Electrical Code and for conceiving, developing and administering the Standard Symbols for Wiring Plans, now, through his untiring zeal, established nationally under the American Standards Association."



SOUTHWESTERN NECA representative George A. Seaman (left), Fort Worth, Texas, corners executive committeeman George L. Gamp, St. Louis, at recent NECA special meeting in St. Louis.



AMONG MILWAUKEE'S contractors at recent NECA meeting in St. Louis were (L to R) Walter Hesse, Trester Service Electric Co., and H. C. Adolphsen, H. C. Adolphsen Electric Company.

INCANDESCENT LIGHTING FIXTURES

Restrictions on the use of metals in utility type incandescent lighting fixtures have been removed from Order L-212 and minor relaxations affecting other types of incandescent lighting fixtures have been made according to WPB.

Provisions formerly restricting the use of metal in utility fixtures affected chiefly reflectors and recessed fixtures.

Utility fixtures are designed for use in offices, hospitals, and stores, for stage and theatre lighting, exit signs and similar purposes. A distinction was formerly made between these fixtures and industrial fixtures, used in machine shops, warehouses, power plants, docks and other manufacturing storage and transportation areas. With the removal of metal restrictions in today's amendment to the order, both types are merged.

Under Order L-212 they are subject only to the provision requiring a preference rating on sales. In addition to the five exemptions from the preference rating provision already in the order, the following two exemptions are made: (1) exit signs of the kind required in public buildings by fire laws; and (2) illuminating glassware, such as bowls, shades, and globes.

Residential fixtures, used for illumination in homes, may be sold without ratings.

Weight restrictions on metals in residential fixtures are relaxed and revised for clarity. A total of 20 ounces of metal may now be used in the fixture. Formerly, 12 ounces of metal could be used and an additional eight ounces could be used for chain or stem of a suspended fixture.

Aluminum may be used as a substitute for other metals, within the 20 ounce limitation. However, the amount of aluminum and steel (by weight) used in the third quarter, 1944, may not exceed the amount of steel (by weight) that had been allotted to a manufacturer for the quarter. The number of units made by a manufacturer may not be greater than the number that would have been made with the allotted steel.

Dependable Protection



MONARCH FUSE COMPANY, LTD.

116 E. FIRST STREET JAMESTOWN, N. Y.

PARTS FOR FANS MOTORS CONTROLS

PROMPT SHIPMENT FROM LARGE STOCKS

AUTHORIZED PARTS DISTRIBUTORS

Brown-Brockmeyer
Century
Cutler-Hammer
Delco
Diehl
Duro
Emerson
General Electric
Hamilton-Beach
Holtzer-Cabot
Howell
Hunter
Ilg
Leland
Marathon
Master
Peerless
Robbins & Myers
Star
Thor
Wagner
Westinghouse

READING ELECTRIC COMPANY, INC.

Parts Distributors for the Manufacturer

200 William St. ***Barclay 7-6616*** **New York 8, N. Y.**

MASTER Power Blow HAMMERS

Most powerful..most versatile electric hammers made!





Save time . . . last longer

FOR DRILLING ½" up to 2" diameter holes in concrete and other hard materials.

FOR CUTTING concrete and other materials. For vibrating, tamping, chipping steel, cast iron and wood...scaling and caulking...peening welds and other heavy work.

FOR SPADING, cutting clay and similar materials.

Available with tools for drilling, cutting or spading. Will do light duty work or any heavy duty work. The Master Hammer runs without striking a blow until pressure is applied, enabling operator to control blow as job requires. Easy and economical to operate. Built for light weight and long service. Used throughout the world. Power blow hammers operate on 115 volt AC or DC, 25, 50, or 60 cycle. If no electricity is available use Master Portable Generator Plant Model 650 (illustrated above).

Write for Bulletin 500 for complete details.

MASTER VIBRATOR COMPANY

Dayton 1, Ohio • Distributors throughout United States and Canada

Products Include: Concrete Vibrators, Gas or Electric Surfacing Attachments, High Speed Tools • Vibratory Concrete Finishing Screeds • Rotary Concrete Floor Finishing Machines • Portable Gas Electric Generator Plants, 500 Watt to 17000 Watt, Voltage Regulators and Portable Mountings Optional • Master Flood and Shovel Lights • Electric or Gas Engine Driven Power Blow Hammers



***FROM NEW YORK** area came (L to R) Louis D. Kennedy, Greater City Electrical Contractors Assn., New York City; Dennis J. Crimmins, New York Electrical Contractors Assn., and Ernie E. Hedler, manager, Philadelphia Chapter, NECA, to discuss postwar problems at NECA special meeting in St. Louis.*

BALLAST AND TRANSFORMER INVENTORIES

Manufacturers and assemblers of fluorescent lighting fixtures and electrical wholesalers selling ballasts and transformers for such fixtures must each file a report stating ballast and transformer inventories, the amount used and the amount on order for the year 1944, the War Production Board has announced.

These reports, due on or before September 15, 1944, are to be made on WPB Form 3894. They must be filed by all manufacturers, assemblers and wholesalers who, on September 1, will have in inventory 100 or more units of all types of ballasts and transformers for fluorescent lighting fixtures; or who used 500 or more units in 1944; or who had on order for delivery 500 or more units in 1944.

Ballasts are used with hot cathode fluorescent lighting fixtures; transformers are used with the cold cathode type of fixtures. They are made by the same manufacturers and utilize the same production facilities as radio and radar coils and other transformers for combat equipment. Because of heavy military demand, production of ballasts and transformers for fluorescent fixtures has been curtailed by WPB. This, in turn, has curtailed production of the fixtures.

Copies of WPB Form 3894 have been mailed to approximately 250 manufacturers and assemblers and to 1,750 electrical wholesalers. Persons who should file the report and do not receive the form by mail should obtain copies from the nearest WPB field office, officials said.

NERA OPENS CHICAGO OFFICE

The National Electrical Retailers' Association established headquarters in the Merchandise Mart in Chicago early in July as plans were formulated to launch a nationwide membership drive. In an active campaign appliance, radio and

lighting dealers will be invited to become charter members.

M. R. Rodger is coordinator of the Association. He will devote a great deal of his time to the membership drive and the development of the association's program. Mr. Rodger, who has spent 25 years in the industry, has been actively affiliated with the new organization from its inception. He is widely known for his ability to correlate activities of the various branches of the electrical industry.

C. B. Sikking, Springfield, Ill., dealer was elected president and J. A. Cobbey, Chicago attorney, acting secretary. Plans are underway to create a board of directors to be nominated and elected by members. There will be an advisory council and regional and local coordinators to build the association.

STREET LIGHTING PROMOTION CAMPAIGN LAUNCHED

One of the most important services which can be rendered in the direction of adequate lighting in the heavy traffic days after the war will be the provision of practical information for the use of:

1. Municipal officials who must make the decision and have it agreeable to the public.
2. Utility executives who must provide new equipment and electrical energy and who should receive fair payment.
3. The public who will do the dying in traffic accidents unless considerable street lighting is installed, and who consequently need to understand its values.

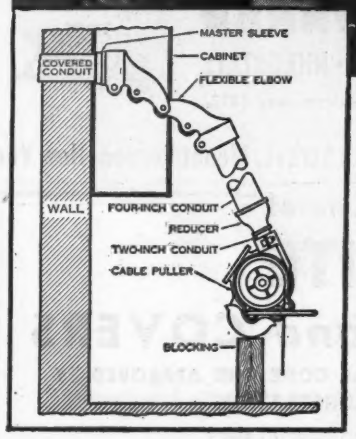
These three types of information will be furnished on an organized scale by means of an Industry Promotion Program sponsored by the Street Lighting Section of NEMA, through the Street and Traffic Safety Lighting Bureau.

The program is outlined jointly by V. J. Lajeunesse, chairman of the Section and A. F. Dickerson, chairman of the Bureau. The public will be introduced to the plan through various channels of information and through direct utility outlets.

"It is our belief", Mr. Lajeunesse said, "that if the utilities are properly sold on the idea of promoting street lighting, they will in turn sell an important segment of the public through talks to women's clubs, civic groups, merchants' associations, through window and lobby displays, the circularization of literature provided by the Street and Traffic Safety Lighting Bureau and through the setting up of demonstration streets and areas."

As part of the appeal to municipal officials, the Bureau will prepare a monthly newsletter to be sent directly to them or be distributed through the utilities or through the facilities of the Street and Traffic Safety Lighting Bureau. This newsletter will contain a condensation of news stories, articles and editorials on street lighting appearing in current magazines and newspapers; street lighting promotion plans and activities of cities; accident statistics and street lighting promotion material. It will be supplemented by monthly direct mail pieces.





PULLING FROM CONCEALED CONDUIT. Where the standard clamping device cannot be used, a flexible elbow attachment makes possible use of the Puller without frame, placed at any desired distance from end of conduit. One end, with master sleeve, attaches to conduit, other end to suitable length of 4" pipe which serves as an extension. Tension drum is assembled at end of this extension pipe, supported with blocking. Roller guide spools direct pulling force . . . clamping sleeve exerts the holding force on conduit. No tendency for tool to rise upward in operation. Operates on vertical conduit also.

OTHER GREENLEE TIME-SAVING TOOLS FOR ELECTRICAL WORK:

PIPE BENDERS
JOIST BORERS
KNOCKOUT TOOLS
RADIO CHASSIS PUNCHES
PIPE PUSHERS

USE the GREENLEE Cable Puller to *pull in line with the conduit*... get a fast, easy pull without straining conduit hangers... eliminate heavy cumbersome equipment... save hours of work! Why? Because by clamping the Cable Puller directly on to the conduit you are applying a holding force to the conduit itself, through the channel-iron frame... creating a force equal to the outward pull of the cable!

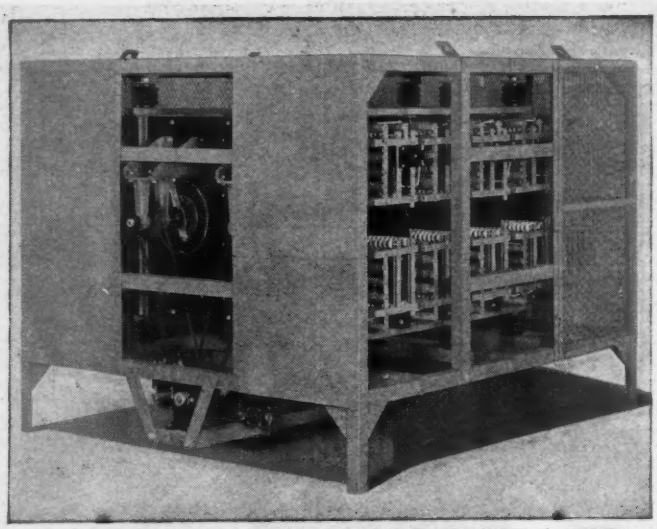
With this GREENLEE you get pull up to 7500 lbs. through any and all conduit, straight or bent, open or covered, on long or short runs. The tension drum is adjustable and swivels in a full circle to provide clearance in close quarters. It's a portable tool—conveniently carried, quickly set up, easily operated by one man.

Write for free Catalog 33E on GREENLEE Cable Pullers and other time-saving tools for electricians. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1749 Columbia Avenue, Rockford, Illinois.



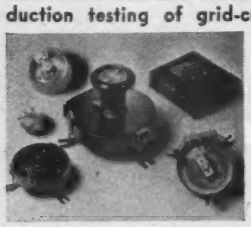
Get Ready with Greenlee!

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN



ASSEMBLED RHEOSTATS

This Ward Leonard rheostat, built for production testing of grid-controlled rectifier tubes, consists of five face plates, each composed of two rheostats. Each rheostat will drop from 0 to 375 volts at any current from 15 to 0.15 amperes. Series connected they drop 3750 volts. Parallel connected they handle curents up to 150 amperes.



Ward Leonard rheostats provide control for the minute current requirements of the laboratory to the heaviest current demands of industry. Send for rheostat bulletins of interest to you.

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) devices since 1892.

ARMY E NAVY

WARD LEONARD ELECTRIC COMPANY, 28 South Street, Mount Vernon, New York

A Complete Line of

BAKELITE

OUTLET BOXES *and* COVERS

THAT MEET THE NATIONAL ELECTRICAL CODE AND APPROVED BY FEDERAL HOUSING ADMINISTRATION

BOXES FURNISHED WITH OR WITHOUT CLAMPS



No. 3050 No. 4050 No. 5050 No. 6050 No. 7050



Nos. 3051 & 4051 Nos. 3052 & 4052 Nos. 3053 & 4053 Nos. 3054 & 4054 No. 4055 Nos. 3057 & 4057 Nos. 3056 & 4056

SAFE • ECONOMICAL • DURABLE • NEAT

The sizes and design, except for clamps and wire knockouts, same as standard metal outlet boxes. They take standard type of fixture studs. Two clamps supplied with each box. The wire clamps hold against 125 lbs. pull. When used with fixture studs they withstand over 400 lbs. pull on stud.

These Bakelite Outlet Boxes have side knockouts and clamps to take 14-2, 14-3, and 12-2 non-metallic sheathed cable, and 14-2, 14-3, 12-2 and 12-3 CNX Type Cable and one ½ in. Bottom Knockout.

These covers are sufficiently thick to obviate breakage in installation or use. Standard color Black.

UNION INSULATING COMPANY, INC.

FACTORY: PARKERSBURG, W. VA.

SALES OFFICE: 27 PARK PLACE, N. Y. C.

containing before-and-after pictures and which in subject matter and sales appeal will parallel consumer advertising.

An important phase of industry promotion directed toward the utility executives will be another newsletter, somewhat similar to the one for municipal authorities, also to be supplemented by monthly direct mail pieces stressing the public relations value of good street lighting and showing how street lighting can be put on a profitable basis. Both of these media are expected to serve as a medium for the exchange of ideas, with the basic theme tying in with municipal official and consumer promotion.

The utility advertising plan of the Section and Bureau for the next several months also calls for a series of display ads in electric utility trade magazines.

Through personal contact, direct mail and trade magazine advertising other sales helps to be made available to the utilities for their use in selling municipal officials and the public will include exhibits, movie shorts, publicity releases, and sales portfolios containing an outline of the Bureau's and Section's advertising and sales program, sample trade paper advertisements, photographs of artist's sketches of window display and samples of the direct mail material which will be made available to utilities for mailing to municipal officials.

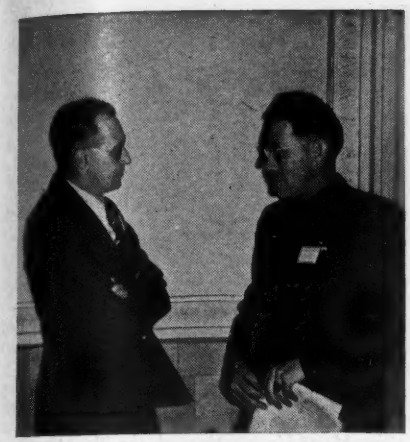
Augmenting the entire program, the Street Lighting Section of NEMA will distribute a "Suggested Street Lighting Plan Book for Utilities" to executive and lighting specialists. While by no means expected to solve the individual problems of the several utilities, it is intended to serve as a guide in order to simplify local preparation of a similar manual.

According to Mr. Dickerson the motif of the whole program will be:

1. To sell the public on the idea of insisting upon and being willing to pay for adequate lighting by stressing resulting reduction in accidents, saving lives, curbing crime, improving nightime shopping, enhancing property values and a monetary saving of far more than actual cost.
2. To impress upon municipal officials the idea of definitely planning the postwar modernization and extension of street lighting systems by showing that good street lighting builds good will.
3. To sell public utility executives on the need to promote street and highway lighting by showing it can be profitable to them.

SURPLUS ELECTRICAL MATERIALS BIDS INVITED

Sealed bids for surplus electrical wiring materials, including conduit fittings, potheads, wire connectors, lugs, receptacles, boxes, hangers and a variety of other materials totalling about 1200 items, will be received by the Kansas City Regional Procurement Office of the U.S. Treasury Department on September 19. Copies of bidding conditions, list of items and bid forms may be obtained from the Kansas City regional office.



RURAL INSPECTION problems are aired at N.C.E.I. War Conference by (L. to R.) H. V. Cooper, Supt. Water and Light Board, Waseca, Minn., and John M. Brende, REA electrical inspector of Colman, South Dakota.

VETERAN APPRENTICE TRAINING URGED

That returning veterans are essential to industry to fill the gap in the ranks of young workers in training for the skilled trades was stressed by William F. Patterson, Director of Apprentice-Training Service, War Manpower Commission, Washington, D. C., in an address on August 23 before the fifty-second Annual Convention of the Wisconsin State Federation of Labor. The meeting was held at Federation headquarters in Oshkosh.

The exodus of young men of apprenticeable age for combat service, Mr. Patterson explained, has opened up opportunities for career training in industry to returning service men who are physically fit for all-round skilled work.

"Selective Service", he said, "has not only skimmed off the cream of the apprenticeship crop, but it has also shut off the largest source of potential apprentices —the 18 year old group of high school or technical school graduates."

"It is certain", he added, "that for at least a few years following the close of the war, the returned veteran group will provide the largest single source of apprentice material. Many of these will return to apprenticeship programs to finish their training. Thousands will receive credit on their term of apprenticeship for experience gained in the armed services. Other veterans who have experienced the satisfaction of doing mechanical work will want to continue and complete their training in a modern apprenticeship program."

Referring to the so-called "GI Bill of Rights" recently passed by Congress, Mr. Patterson pointed out that the bill provides financial aid to veterans who take jobs as apprentices. Those eligible will receive subsistence payments in addition to the wage paid apprentices by employers. These payments will range from $50 a month for single men to $75 a month for those with dependents.

"This is an important point," Mr. Patterson declared, "because most service



—It's the best reflecting surface known

"SURE, they're porcelain enameled reflectors... the only kind we'd think of buying.

"Of course, we heard about wartime 'substitutes' for porcelain enamel. But the truth is that no satisfactory substitute for it has ever been found as a reflecting surface for industrial lighting equipment.

"Porcelain enamel gives you the highest known reflective efficiency. The finish is permanent—unaffected by atmospheric conditions—good for a lifetime. And it's by far the easiest surface to keep clean; to maintain high standards of illumination."

That's correct, of course, for average plant requirements. But where light must be thrown a considerable distance, as in floodlighting, we recommend Alzac aluminum.

Sold through electrical wholesalers



GOODRICH
ELECTRIC COMPANY
4600 BELLE PLAINE AVENUE, CHICAGO 41, ILLINOIS

ELECTRICITY
For Any Job—Anywhere

For a dependable source of electricity on projects remote from commercial power, Onan Electric Plants are proven leaders in the field. More than half of the Armed Forces' total requirements for Power Plants are built by Onan.



Gasoline driven . . . single-unit, compact design . . . Sturdy construction . . . Suitable for mobile, stationary or emergency service.

Over 65 models, ranging in sizes from 350 to 35,000 watts. 50 to 800 cycles, 115 to 660 volts, A.C. — 6 to 4000 volts, D.C. — Also dual A.C.-D.C. output types.

Descriptive literature sent promptly on request.

D. W. ONAN & SONS

2093 Royalston Ave.

Minneapolis 5,

Minnesota

ONAN
ELECTRIC PLANTS

You can always depend upon **Revere**

THE COMPLETE QUALITY LINE



Steel Poles 20 to 60 feet high.

750 - 1000 - 1500 Watt Enclosed type floodlight with rotation feature.

300 to 1500 Watt Eliptor open type floodlight.

Combination area light and spot light for one or two top floods.

500 Watt Enclosed (Navy) Type Flood. Rugged. Concussion, Vibration and Exposure Resistant.

Revere Hinged Poles — Safety —no hazardous climbing — Service floodlights from the ground. 20 - 24 and 30 foot mounting heights.

Write for Bulletins

REVERE ELECTRIC MFG. CO.
2925 NORTH PAULINA STREET · CHICAGO 13
Originators of the Hinged Floodlight Pole
INDOOR and OUTDOOR LIGHTING EQUIPMENT of EVERY DESCRIPTION



STATEWIDE CONDITIONS in the electrical contracting field are aired at the Memphis meeting of the Tennessee Electrical Contractors Association by (L to R) contractors R. Mitchell Murphy, Knoxville; J. N. Townsend, Jackson; and E. E. Frost, Trumbull Electric Mfg. Co., Nashville, Tenn.

men are above the average age of entering apprentices, and many will have acquired a family while in service.

"The challenge then, to management, labor and government representatives alike, is to provide these younger returned veterans with the best possible types of apprenticeship program, closely geared to the needs of industry. The successful solution to this problem can provide a large measure of employment and job security for several hundred thousand American youths, both veterans and non-veterans in the peace era ahead.

"That organized labor is aware of the need and importance of ever improving the knowledge and skill of its workers, is well exemplified by the recent decision of the International Brotherhood of Electrical Workers to establish a training center in electronics at Marquette University. At this training center, representatives from the various locals will take an intensive six weeks course in electronics theory and practice.

"The purpose is two-fold: to train the journeyman to go out and install and maintain electronic machines of the more common types; and to fit the journeyman to become an instructor so that he may in turn instruct members of his own local. The international office has requested that each local plan to train a class in electronics practices, and it is hoped that in this way more than 25,000 electrical workers will have their skills upgraded to include basic knowledge of this new field which has developed so rapidly under the pressure of wartime necessity. Large industrial producers of electronic equipment are cooperating in this program.

"We believe it is highly significant that the electrical workers should have undertaken this highly advanced form of upgrading program for its members. Their organization always has been in the forefront of the movement for better apprenticeship and trade educational programs. They have seen the threat to the craft in any failure to keep abreast of modern industrial advances. No more farsighted statement on the part of any industrial leader could be imagined than that from

President Brown of the I.B.E.W. in announcing this new electronic project. I want to read you part of his message, I quote:

"In view of the fact that the International Brotherhood of Electrical Workers has the majority of skilled men in the electrical industry, the industry must look to the union for trained men in the electronics field. Electronics electricity is an advanced branch of the electrical industry. It is but natural that skilled mechanics already engaged in utility, maintenance, railroad, radio and electrical installation will furnish the best type of workmen to enter and train members in the new field of electronics.'

"I need not stress the crisis in the affairs of the organization. It is plain. If the International Brotherhood of Electrical Workers does not meet this dire need and train the men to install, maintain and man the new electronics machines, the organization may find itself soon 'all dressed up and no place to go' and the members losing work opportunity.

"As *The Journal of Electrical Workers and Operators,* points out:

"The National Joint Aprenticeship Committee, struggling with the problem of standards in the electrical industry, sees the new national electronics school as but an extension of the training that the Brotherhood has been giving its men over a period of many years. The National Apprenticeship Standards promulgated by the unions and the contractors state: 'Post-graduate courses are desirable that journeymen may keep pace with this changing science. As viewed by the electrical construction industry, general training should and does precede specialization on the part of the apprentices or the journeymen!'"

As evidence of the opportunities for veterans who wish a career in a skilled trade, Mr. Patterson stated that as many as 5,284,900 all-round skilled workers were employed in industry in 1940, the last peacetime year. To maintain a skilled worker force that size, he said, at least 600,000 apprentices must be kept in train-

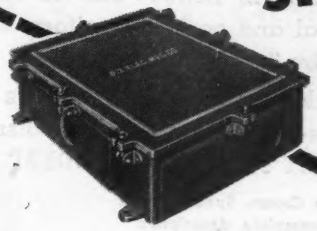


POWER RECOVERY system at Dodge-Chicago plant is analyzed by E. L. Bailey, electrical engineer, Chrysler Corp. (right) as L. A. Kilgore (left) and H. Speight, both of Westinghouse Electric & Mfg. Co., look on, at A.I.E.E. summer technical session in St Louis.

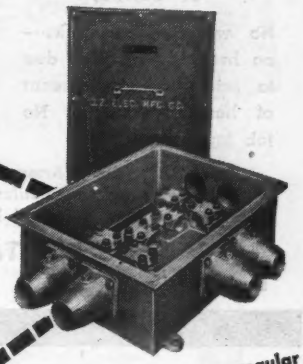
O. Z. Cast Iron Junction Boxes are designed by engineers whose experience covers a quarter of a century of service to the electrical construction industry. These boxes bear the stamp of high quality material, working efficiency, and lasting service under diverse operating conditions. Special types are recommended for railways, docks, bridges, underground systems, industrial plants, and highways.

O. Z. anticipating an upward trend in building and construction, has expanded its line of electrical fittings to include a complete range of types and sizes of Junction Boxes, both of standard design, or built to individual job requirements.

O.Z. JUNCTION BOXES
Standard . . . or to Your SPECIFICATIONS



This weatherproof pull box can be used with cut-outs, terminal strips, or other equipment. One piece rubber gasket in the groove of the cover makes a water-proof box.



An adaptation of one of our regular boxes fitted with an O. Z. distribution center and flanged wiping caps.



Heavy Duty Type Junction Box. Can be used for surface or flush mounting. Available with rubber gasket (as shown) or with raised cover for heavy explosion-resisting work.



This new Flange Type Wiping Cap has been added to the regular O. Z. Wiping Cap line. Adaptable for use with Junction Boxes.



MORE THAN A CATALOG

This new O. Z. publication contains 144 pages attractively bound in loose-leaf form. More than 160 O. Z. electrical fittings are described, illustrated, with photo diagrams, specifications and prices. Included are O. Z. Conduit Fittings . . . Cable Terminators . . . Solderless Connectors . . . Power Connectors . . . Grounding Devices. Designers, engineers and contractors in the electrical field are offered this valuable guide at no cost. Send for your copy.





O.Z. ELECTRICAL MFG. CO.
262 BOND STREET BROOKLYN, 2 N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

TAL'S *Prestal*
HYDRAULIC PORTABLE



PATENTS and PATENTS PEND.

PIPE BENDER

for steel pipe and conduit from ⅜" to 4½"

- **NO HEATING**
- **NO FILLING**
- **NO KINKS**
- **NO WRINKLES**

Make your offsets and bends up to 90° (and more) in one single, simple operation in a few minutes.

The pipe is NOT MOVED during the bending thus avoiding kinks and wrinkles. All bends—one or 1000 all identical and perfectly uniform even if made by "green hands."

Quick changeover to various sizes. Few seconds to mount and dismount. FASTEST PORTABLE BENDER!

SMOOTHNESS OF BENDS:

No wrinkles—no kinks—no breaking of pipe due to scientific development of bending formers. No job too complicated.

Meets U. S. Navy, Army & Maritime Comm. Specifications
Write today for circular giving complete description
New Jobbers and Representatives Considered

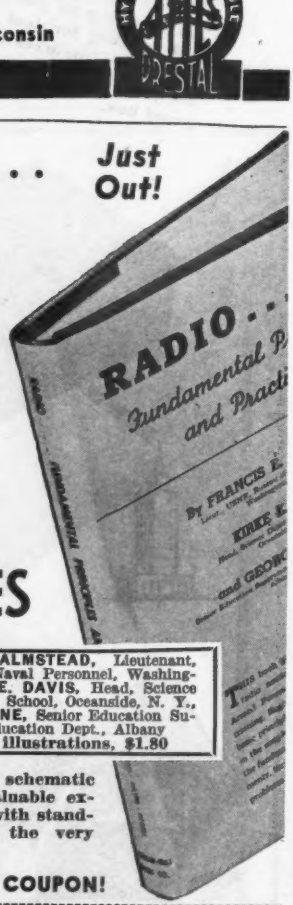
TAL'S PRESTAL BENDER, INC.
Dept. E-9 **Milwaukee, Wisconsin**

HYDRAULIC PORTABLE TAL'S PRESTAL

Radio fundamentals . . . theory and practice simply, concisely explained

Just Out!

Here is a book you can pick up with no previous radio knowledge and get a basic understanding of radio functions necessary for practical radio work as repairman, technician, or operator. It covers the operating principles of current, circuits, and instruments and will give you an easy familiarity with terms and equipment, with diagrams and basic principles.



RADIO FUNDAMENTAL PRINCIPLES AND PRACTICES

By **FRANCIS E. ALMSTEAD**, Lieutenant, U.S.N.R. Bureau of Naval Personnel, Washington, D. C., **KIRKE E. DAVIS**, Head, Science Dept., Oceanside High School, Oceanside, N. Y., and **GEORGE K. STONE**, Senior Education Supervisor, The State Education Dept., Albany
219 pages, 174 illustrations, $1.80

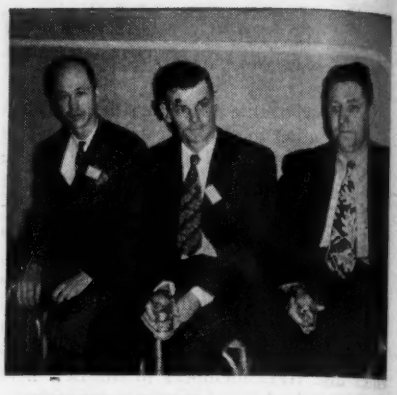
This book starts with an explanation of the electron theory and goes on to current, vacuum tubes, inductance, capacitance, resonance, circuits, amplifiers, transmitters, antennas and transmission lines. It gives you an understanding of power supply and shows the radio instruments of power control, and it explains sound as applied to radio—frequency, wave calculations, microphones, etc.

• 162 accurate schematic drawings provide valuable experience in dealing with standard symbols from the very beginning.

SEE IT 10 DAYS FREE—SEND THIS McGRAW-HILL COUPON!

McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.
Send me Almstead, Davis and Stone's RADIO: FUNDAMENTAL PRINCIPLES AND PRACTICES for 10 days' examination on approval. In 10 days I will send $1.80 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....Position .....
City and State.....Company .....EC 9-44
(Books sent on approval in U. S. and Canada only.)



***SESSION RECESS** at recent Memphis meeting of the Tennessee Electrical Contractors Association finds (L to R) Charlie Norton, Square D Co.; Jack Hunt, Shelby Electric Co.; and W. B. Davis, W. B. Davis Electric Supply Co., enjoying a bit of relaxation.*

ing continuously; and out of that number fully 100,000 must be graduated to full-fledged craftsmanship every year. To keep 600,000 men in training all the time, approximately 200,000 additional apprentices must be employed each year. This estimate of the training problem ahead was determined, he explained, by Apprentice-Training Service. It allows for turnover of skilled workers and apprentices, as well as graduation of apprentices.

"In spite of war induced handicaps," he added, "industry has continued to make every effort to keep existing apprenticeship programs going with apprentice material available. Furthermore, it has continued to establish and make ready new programs for use as soon as returning veterans and other youths are available to enter them. We have as a result, a time tried and experienced tested apprenticeship system standing ready to expand when world conditions again permit. The only thing lacking at the moment is apprentices. Where are we to get them? The obvious answer is from among the younger returning veterans—the sons of our Nation who may wish to enter a program that will teach them a skilled trade and a worthwhile way of life."

Book Reviews—

TEXTBOOK OF ADVANCED MATHEMATICS

A textbook for a course in advanced calculus of a type now taken by many students whose major field of interest is engineering, mathematics or science. It may also serve as a reference for practical engineers who need to refresh and improve technique in applying elementary calculus.

Early chapters deal with topics touched on in elementary calculus, Taylor's series, partial differentiation and its geometric applications, and integration. Later chapters deal with special higher functions. Fourier series, ordinary and partial differential equations, vector analysis and the calculus of variations.

Methods of Advanced Calculus by Philip Franklin, Ph.D. McGraw-Hill Book Co., Inc., $4.50.

RADIO PRINCIPLES

A short and concise text for the average student with a foundation of high school physics and a working knowledge of elementary algebra. Beginning with the electron theory it explains basic principles of radio bringing in theory, equipment, operation, instruments, terms and the mathematics necessary to solve radio problems.

The book is intended as an aid to acquiring a sound foundation in fundamental principles and practices, and is useful to the beginner as background for further study in industrial electronics and radio.

Radio . . . Fundamental Principles and Practices by Francis E. Almstead, Kirke E. Davis and George K. Stone. McGraw-Hill Book Co., Inc. $1.80.

DATES AHEAD

Southwestern Division, NECA — Third Semi-annual conference, Skirvin Hotel, Oklahoma City, Okla., September 9-10.

International Association of Electrical Inspectors—Western Section, Claypool Hotel, Indianapolis, Ind., September 11-13; Eastern Section, DeWitt Clinton Hotel, Albany, N. Y., September 18-20; Southern Section, Ausley Hotel, Atlanta, Ga., September 25-27.

George Washington Chapter IAEI — Monthly meeting, District Building, Washington, D. C., September 11.

Central District Chapter NISA—Monthly meeting, Electric Association Dining Room, 20 N. Wacker Drive, Chicago, September 12.

Rocky Mountain Chapter IAEI—Monthly meeting, Denver, Colo., September 12.

New England Chapter, NISA — Boston, Mass., September 14.

Illuminating Engineering Society—Annual conference, Edgewater Beach Hotel, Chicago, Ill., September 14-16.

Roger Williams Chapter IAEI—Monthly meeting, Providence, R. I., September 20.

International Association of Electrical Leagues—Ninth Annual conference, Detroit, Mich., September 20-22.

American Standards Association—Standards Council, New York, N. Y., September 21.

Indoor Climate Institute—A two-day Open Forum, Book-Cadillac Hotel, Detroit, Mich., September 21-22.

Electrical Credit Association, Chicago Chapter—Annual meeting, September 21.

National Electrical Contractors Association—Annual meeting, French Lick Springs Hotel, French Lick, Indiana, Oct. 1-5.

International Municipal Signal Assn.—Annual meeting, Hotel Statler, Boston, Mass., Oct. 2-4.

Utah Chapter IAEI—Monthly meeting, Salt Lake City, Utah, October 3.

National Electronic Conference—Medina Club, Chicago, Ill., Oct. 5-7.

National Safety Congress of National Safety Council—Sherman, Morrison and La Salle Hotels, Chicago, Ill., October 3-5.

Eastern New England Chapter, IAEI—United Shoe Machinery Building, Boston, Mass., October 18.

Electronic Parts and Equipment Industry Conference—Stevens Hotel, Chicago, October 19-21.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 23-27.

Electrical & Gas Association of N. Y., Inc.—Thanksgiving Luncheon, Grand Ballroom, Hotel Astor, New York, N. Y., November 22.

National Electrical Manufacturers Association — Spring Conference, Palmer House, Chicago, April 16-19, 1945.

International Lighting Exposition — Palmer House, Chicago, Ill., April 19-23, 1945.

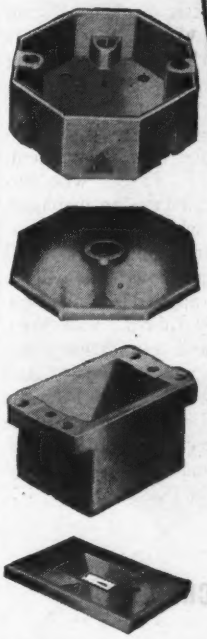
National Electrical Wholesalers Association—Spring meeting, April 23-25, 1945.

ILLINOIS

Completely Insulated

ALL PORCELAIN WIRING SYSTEMS

for HOME, COMMERCIAL AND INDUSTRIAL WIRING *Conserve* STEEL, ZINC, COPPER, RUBBER



OUTLET BOXES

Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knock-out holes and mounting screws. High mechanical and electrical efficiency.

SWITCH BOXES

Insure greater safety in wiring and the elimination of all grounding hazards. Made of best quality white porcelain. Metal inserts are placed in two holes of the switch boxes for receiving screws of standard switches, plugs, outlets, etc. Knockouts for single wires, also for cables. Specify and use them.



STANDARD TUBES

In sizes ½ to 48 inches, 5/16- to 3-inch diameter in following types: unglazed, glazed, split, floor, split floor, headless, curved end, cross-over split, and cross-over. Diameters all uniform both inside and outside.



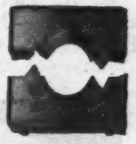
KNOBS

Cement coated — nail — genuine leather-washer — code standard. They don't chip when driven in and they stay in place.



TOGGLE SWITCH PLATE

All porcelain with beveled edge and decorative pattern on face.



CLEATS

Standard one, two, and three-wire types.

● Not only because porcelain saves vital materials is it valuable today but because these systems give you highest standards in results and offer your customers permanent wiring. Porcelain systems are safe, easy to install, and adaptable to practically all wiring plans and layouts. Grounding is unnecessary. No rusting or corrosion. Install ILLINOIS All Porcelain Wiring Systems the next time you have a wiring job.

Bull Dog REGISTERED

Look for this Trade Mark

ILLINOIS ELECTRIC PORCELAIN CO.

MACOMB, ILLINOIS

MANUFACTURERS NEWS

SYLVANIA APPOINTMENTS

Sylvania Electric Products Inc. has promoted Frederic J. Robinson to the position of sales manager for Latin America.

Philip M. Pritchard, a member of the sales staff of the Radio Division for the past eight years, has been promoted to manager of Equipment Tube Sales for the East Central Division. He will make his headquarters at the New York Office.

E. Bruce McEvoy, Jr. has been appointed assistant to L. S. Raynor, radio tube equipment sales manager for the Eastern Division. Mr. McEvoy will make his headquarters at the New York Office.

Raymond K. Burnet, who was formerly associated with Walter E. Heller & Co., was appointed to the radio tube equipment sales staff. He will make his headquarters in the Chicago Office.

G-E APPOINTMENTS

General Electric Company announces the appointment of Elliott Harrington as manager sales of a newly-formed integral-horsepower alternating-current motor section, located in Schenectady, which includes all such induction motors now manufactured in the Lynn, Schenectady, and Oakland Works.

J. T. Farrell has been named manager sales of the newly-formed integral-horsepower direct-current motor section, also located in Schenectady, with commercial responsibility for all such motors and generators now made in the Lynn, Erie, and Fort Wayne plants.

D. A. Yates has been appointed assistant manager sales of both sections in charge of Lynn motor sales group, and will be located at the Lynn River Works.

K. R. Van Tassel was named manager of the Industrial Control Division. He succeeds George R. Prout, recently appointed manager of the company's air conditioning and refrigeration division of the Appliance and Merchandise Department.

Lt. Col. Boyd Bullock has returned from Army service to take over his prewar position as advertising manager of G-E's appliance and merchandise department. At the time of his discharge he was commanding officer of officers' school at Camp Custer, Mich.

RELIANCE CREATES NEW DEPARTMENT

The Reliance Electric & Engineering Company of Cleveland, as part of its preparations for postwar, is establishing a sales promotion department.

Roscoe H. Smith, who has been manager of applied engineering for the company, will head up the new department, assisted by Kenneth F. Ertell, who has been named assistant advertising manager. Richard A. Geuder, who has been manager of metal industry applications, will assume Mr. Smith's previous responsibilities as manager of applied engineering. He will be assisted by John L. Van Nort, until recently sales and application engineer for Reliance in Salt Lake City, and William C. Madsen, who has been on the company's application engineering staff for the past three years. Paul W. Arnold, manager of machinery design applications, continues in that capacity.

WESTINGHOUSE CHANGES

Edgar B. Karns has been appointed manager of the Street and Aviation Lighting Application Section of the Cleveland Lighting Division of the Westinghouse Electric and Manufacturing Company.



E. B. KARNS

Maurice H. Hobbs, manager of Switchboard Engineering has been promoted to manager of Engineering Department of the Switchgear and Control Division; Charles P. West, section engineer in Switchboard Engineering to manager of Switchboard Engineering; and Wilbur C. Fulton, switchboard engineer, to section engineer in Switchboard Engineering.

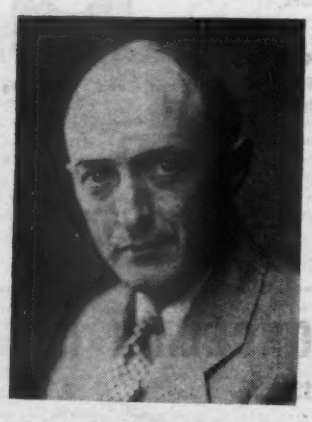
Donald W. McGill has been named manager of the Machinery Electrification Section of the Industrial Department. He succeeds L. F. A. Mitchell, who has returned to the Canadian Westinghouse Company as assistant to the vice president.

Melvin E. Lanning has been appointed merchandise manager of the Electric Range Department of the Electric Appliance Division.

Frank E. Bodine, manager of the Salt Lake City office since early 1941, has been transferred to San Francisco as manager of that office.

Stanley M. Johns has been named manager of the Salt Lake City office. He succeeds Frank E. Bodine.

Harold W. Schaefer has been appointed assistant manager of the newly-formed Radio Receiver Division of Westinghouse.



E. HARRINGTON



J. T. FARRELL



K. R. VAN TASSEL



BOYD BULLOCK

ILG PROMOTIONS

Ilg Electric Ventilating Co., Chicago, has promoted five men on its engineering staff.

Frank P. Bleier, research and development physicist since 1942, has been named director of the new Ilg Research Laboratory. Raymond V. Pfautsch, formerly an engineer assigned to new product design, has been named assistant chief engineer. Richard Hanford, another member of the Engineering Department, has been given the title of electrical engineer. A. J. Lenke, who started with the company in 1922, has been appointed production manager. George Biggott, who joined the company in 1942 as a production specialist, has been placed in charge of production planning and scheduling.

STEEL AND TUBE APPOINTMENTS

J. A. Ireland has been named general manager of sales of the Steel and Tubes Division of Republic Steel Corporation, Cleveland. He succeeds J. V. Burley, who has been made manager of sales of the Carbon Bar Division of Republic in Cleveland.

D. K. Smith, formerly manager of the general sales office, has been appointed central district sales manager. He succeeds J. J. I. Jamieson, who has been made manager of sales, Mechanical Division, of the company.

ANACONDA CHANGES

Dan Mabel has been appointed district manager of the New Orleans office of the Anaconda Wire and Cable Company.

H. V. Van Valkenburg, who for the past number of years has been located in its Washington office has been appointed district engineer with headquarters at Chicago, Ill.



NECA REORGANIZATION plan is discussed at recent St. Louis special meeting by (L to R) Emil Preiss, northeastern representative, NECA; and Walter Knapp, member, executive board, New York Electrical Contractors Association.



Paging by Voice More Efficient!

Employees Respond More Quickly

hearing their own names

Broadcasting to Employees Speeds Output!

Surprising increases in production as a result of the broadcasting continuous music programs to

BELL VOICE-PAGING EQUIPMENT MEETS BOTH SOUND REQUIREMENTS



"MR. C. E. JONES IS WANTED IMMEDIATELY IN THE ENGINEERING DEPARTMENT"



"WE INTERRUPT THE MUSIC FOR A SPECIAL MESSAGE TO ALL EMPLOYEES"

You can now provide any plant with the *double* advantage of speedier paging and faster production with the new BELL Voice-Paging System *designed especially for industrial use.* It broadcasts recorded music, announcements, alarms, and paging calls to any or all areas of any plant. Its widely adjustable, precision-built *standard* units can be grouped to fit any need. Also designed for quick, easy expansion or rearrangement. Get details on this new BELL Industrial Sound Equipment.



WRITE TODAY FOR BULLETIN 37

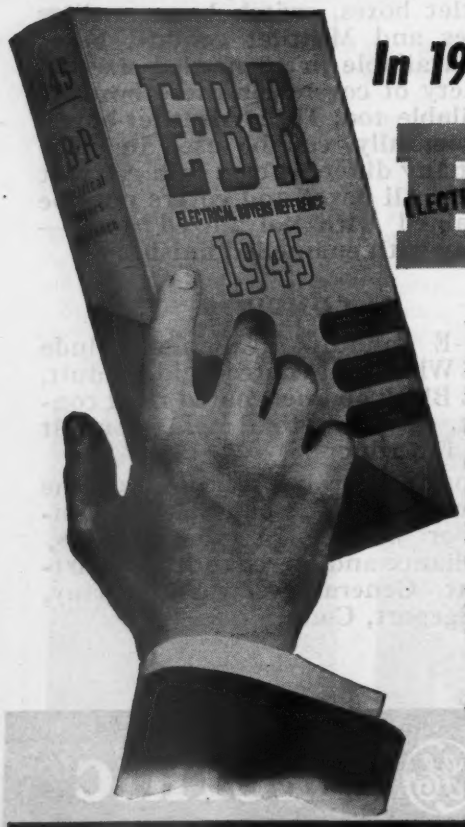
BELL SOUND SYSTEMS

BELL SOUND SYSTEMS, Inc.

1196 ESSEX AVE., COLUMBUS, OHIO

Export Office: 5716 Euclid Ave., Cleveland, Ohio

Briefalog your line!



In 1945, they'll reach for

E-B-R ELECTRICAL BUYERS REFERENCE

Your 1945 line in handy E-B-R *Briefalog* form will reach the men who plan, specify, requisition electrical and allied products. Save catalog production costs; assure proper coverage. Reprints for your own mailings available. 1945 edition closes Sept. 15th. Rush your inquiry to the nearest McGraw-Hill office.

A McGRAW-HILL PUBLICATION

330 W. 42nd St., N. Y. 18, N. Y.

The Pittsburgh Reflector Company, Pittsburgh, has announced the appointment of B. D. Levaur as vice president, director of sales and a member of the board of directors. During the past 18 years he



B. D. LEVAUR

has been Pittsburgh sales representative.

Mr. Levaur attended the University of Pittsburgh, joined the sales organization of Standard Metal Products Company for a short time, and became associated with Pittsburgh Reflector in 1926.

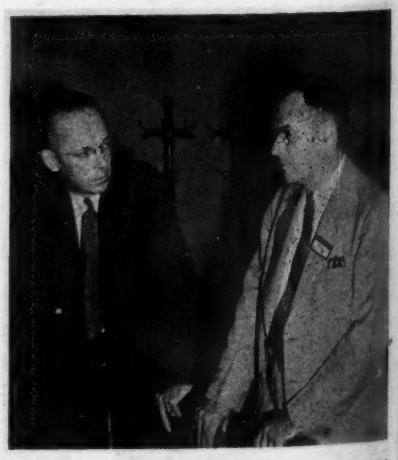
Mr. Levaur will be in complete charge of sales and will make his headquarters at the Pittsburgh office.

•

Electromaster, Inc., Detroit, has named the following distributors in various sections of the United States—D. W. May Corporation, New York City; Luckenbach and Johnson, Inc., Allentown, Pa.; Electric Supply Co., Atlanta, Ga.; Air Engineers, Inc., Birmingham, Ala.; and Automatic Home Equipment Co., Chattanooga, Tenn.

•

Delco Appliance Division of General Motors Corporation, Rochester, N. Y., announces the appointment of M. Lawrence Judd as sales manager of appliances.



***POST-SESSION** huddle finds (L to R) John S. Parsons, Westinghouse Electric & Mfg. Co., East Pittsburgh and E. M. Hunter, General Electric Co., Schenectady, discussing papers presented at the A.I.E.E. industrial power applications session at recent St. Louis Technical meeting.*

A CORRECTION

In the August issue of *Electrical Contracting* under the personnel changes of The Essex Wire Corporation, page 162, it was incorrectly stated that P. E. Stouffer, assistant sales manager, was responsible for magnet wire sales in the central and western territories. Mr. Stouffer is responsible for sales of magnet wire in the eastern territory.

Jim Paton, Jr., assistant sales manager, is responsible for magnet wire sales in the central and western territories.

•

Allis-Chalmers Manufacturing Company has announced the appointment of Howard C. Herbert as a field engineer for steel mills in the Pittsburgh district. Mr. Herbert was formerly Pittsburgh representative of the I-T-E Circuit Breaker Company.

•

The Trumbull Electric Mfg. Co. of Plainville, Conn., announces the appointment of Arthur H. Soper as field representative in the Philadelphia district, assisting Frank M. Oglee, manager.

•

BullDog Electric Products Company, Detroit announces the appointment of C. H. Bates as field engineer, working out of the Boston Office.

•

Champion Lamp Works of Lynn, Mass., announces the appointment of Louis J. Cahill as commercial engineer. Mr. Cahill was formerly assistant illuminating engineer of the Benjamin Electric Mfg. Co.

•

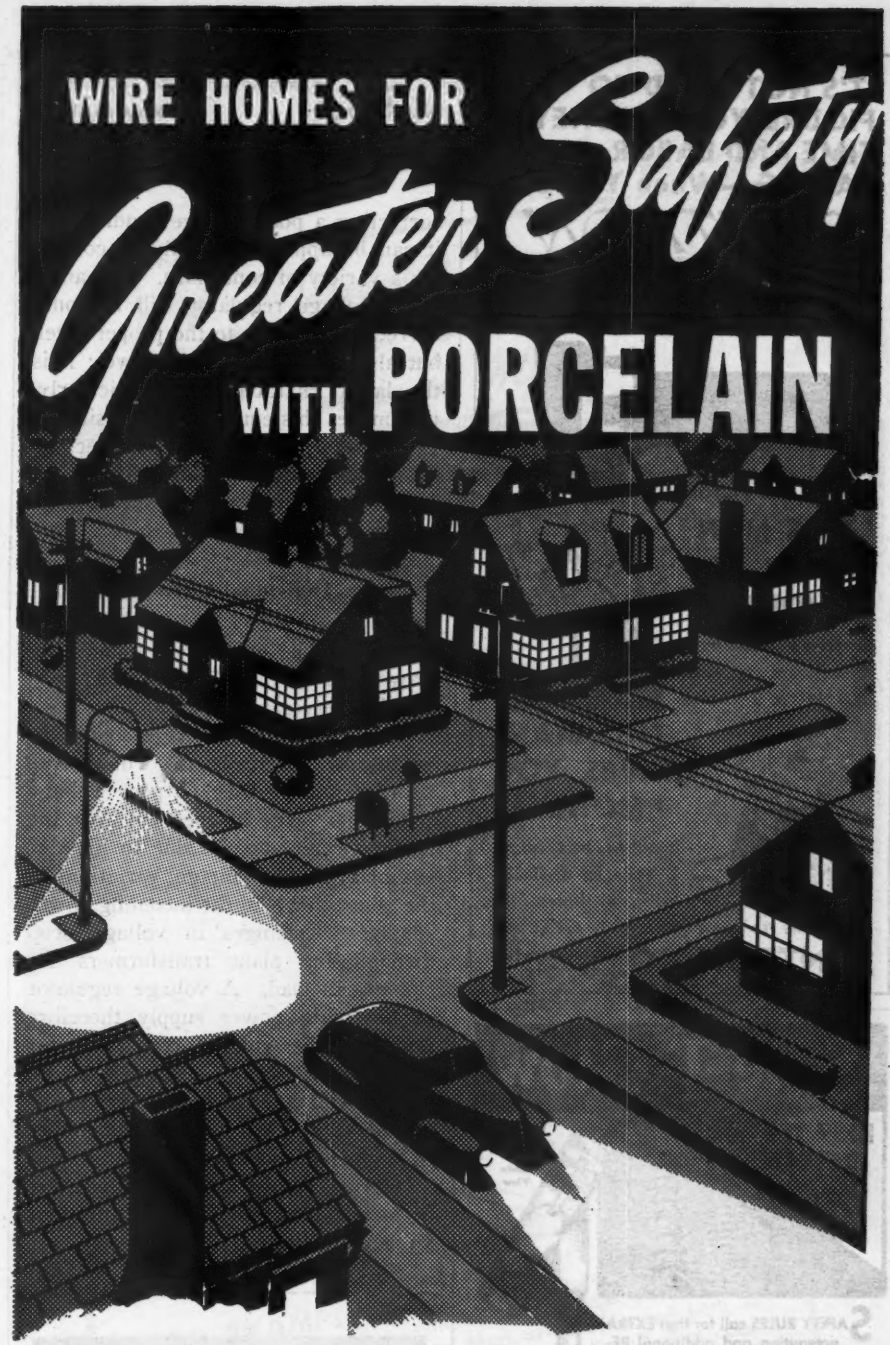
H. Dale Cook has joined the Controls Division of **Perfex Corporation,** Milwaukee, in a sales engineering capacity. He was formerly with the Chicago branch of the General Controls Company.

•

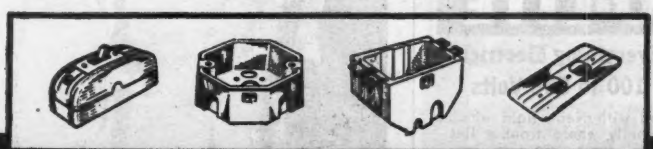
The Federal Electric Products Company of Newark, N. J., has purchased the Electrical Division of Colt's Patent Fire Arms Manufacturing Company, Hartford. The manufacture of motor controls and other Colt products will be continued at Hartford with the same personnel, but under the personal supervision of Thomas M. Cole, executive vice president of Federal.

•

Meissner Manufacturing Co., Mt. Carmel and Chicago, Ill., has named Ray R. Hutmacher as district manager. He will make his headquarters at the Chicago office in the Palmolive Building.



When the lights go on in postwar homes—time-proven PORCELAIN will carry the load with greatest safety, lowest cost, simplest installation and longest life! In all types of "Wiring Today for Tomorrow's Loads"—use Porcelain Protected Wiring! This method does the job without "frills"—it's *tops* for efficiency! Meets all requirements of directives calling for non-metallic wiring materials. Ask your friendly Electrical Inspector about Porcelain and Safety—he has latest fire-prevention facts at his fingertips. Write for wiring manual.



PORCELAIN PRODUCTS, Inc.
FINDLAY, OHIO

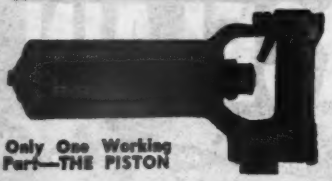
Wire Today for Tomorrow's Loads

IT'S NOT HARD TO FIGURE YOUR MONEY TIME AND LABOR SAVING—When You Use

SYNTRON

DEPENDABLE

ELECTRIC HAMMERS



Only One Working Part—THE PISTON

THIS MAN COSTS YOU $ MONEY $

It takes him over 8⅓ hours to drill 100 ½" x 2" holes



30 Blows per minute



3000 BLOWS PER MINUTE

THIS MAN SAVES YOU $ MONEY $

It takes him about 1 hour to drill 100 ½" x 2" holes

Write today

SYNTRON CO. 690 Lexington Homer City, Pa.

Safe-T-Glow

HIGH TENSION DETECTOR



Cut-Out Shows Inside View

SAFETY RULES call for that EXTRA precaution and additional RE-CHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages . . . prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A 3-ft. handle

Model B 6-ft. added extension

Model A for circuits 2,000 to 35,000 volts. Model B for circuits from 35,000 to 220,000 volts.

TEST-O-LITE



Tests Everything Electrical from 100 to 550 Volts

Equipped with Neon light which tells instantly where trouble lies in circuits, fuses, cut-outs, motors, etc. Indicates hot or grounded wires. Tells AC from DC. SAVES PRECIOUS TIME. Has PATENTED safety features. Vest pocket size with clip. Lifetime guarantee. List $1.50 (Priority A-7). Purchase thru regular electrical dealers.

L. S. BRACH Mfg. Corp.

55-63 Dickerson St. Newark N. J.

Voltage Improvement Methods

[FROM PAGE 42]

correcting a poor voltage condition as it can be applied so easily to correct for a variety of conditions. The automatic voltage regulator will not only correct the voltage to the proper level, but also will *maintain* this level; it is the latter characteristic, particularly, that makes this equipment so desirable. Constant operating voltage is especially desirable for such loads as lighting, infra-red heating, or high-speed series motors.

Individual Circuits

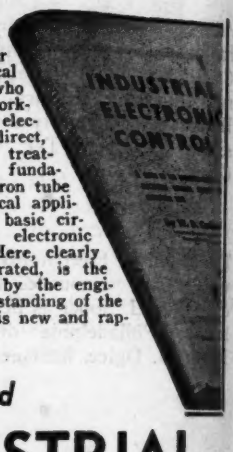
It should be noted that voltage improvement of individual circuits may not be necessary if attention is directed to improving voltage conditions on an overall plant basis. This is true because most causes of poor voltage conditions are independent of the feeder circuit and are due to high or low plant system voltage, variations in the voltage level of the incoming power supply, or changes in voltage drop through the plant transformers for changes in load. A voltage regulator in the main power supply therefore improves the voltage conditions for all feeders.

The voltage conditions in plants should be checked periodically. This is easily done and with the corrective measures readily available there can be no good reason for tolerating poor voltage conditions.



ENGINEERS INTERESTED in equipment discussions at recent A.I.E.E. summer technical session in St. Louis, are (L to R) Lee M. Moore, R.E.A., St. Louis; Fred B. Wipperman, Executive Secretary, NISA, St. Louis; and C. A. Nordquist, district manager, Railway and Industrial Engineering Co., Chicago.

Facts You Need— for selling installing and servicing electronic equipment



This is the first book written especially for the practical electrical man in industry who desires a basic working knowledge of electronic control. In a direct, non-mathematical treatment, it gives you fundamental facts of electron tube operation and practical applications of tubes in basic circuits of industrial electronic control apparatus. Here, clearly explained and illustrated, is the information needed by the engineer for quick understanding of the special aspects of this new and rapidly growing field.

Just Published

INDUSTRIAL ELECTRONIC CONTROL

A Guide to the Understanding of Electronic Control Circuits for Industrial Use

By W. D. COCKRELL

Industrial Engineering Divisions, General Electric Co.

247 pages, 5½ x 8½, 175 illustrations, charts, and tables, $2.50

The book emphasizes the fundamental functions and basic circuits important to an understanding of any control circuit and illustrates them by standard commercial devices in use today. Part I describes the various types of electron tubes and explains their construction and operation. Part II gives you basic circuit components, reviews the fundamental nature of such terms as resistance, capacity and inductance and covers the instruments which measure voltage and current. In Part III the basic electronic circuits are classified into general types, and the necessary parts, the operation, and the common applications of each are described. Part IV shows you how to analyze a complicated circuit and break it down into its component parts, giving standard commercial devices as illustrations.

McGRAW-HILL EXAMINATION COUPON

McGRAW-HILL BOOK CO., Inc.,
330 W. 42nd St., New York 18, N. Y.

Send me Cockrell's INDUSTRIAL ELECTRONIC CONTROL for 10 days' examination on approval. In 10 days I will send $2.50 plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....

Address .....

City and State .....

Position .....

Company ..... EC 9-44

(Books sent on approval in U. S. and Canada only.)

[FROM PAGE 78]

ENGINEERED SHOP LAYOUT ENCOURAGES EFFICIENT PRODUCTION

Efficient production means the greatest output with the least expenditure of energy. The worker must be allotted ample space to accomplish his assigned task without the least cramping. However, he must not be required to do unnecessary stretching or to take unnecessary steps. The alert foreman will see to it that the spacing of shop equipment is adapted to the employee, rather than have the employee adapt himself to some obsolete layout of tools and machinery.

With this thought in mind, the Franklin Tranformer Company of Minneapolis designed a new layout of benches and equipment in the coil winding, dipping and baking departments that would most efficiently produce for the war orders that were flooding in. The new layout also accomplished a partial solution to the growing shortage of skilled labor, in that skilled personnel in employ could produce better and more efficiently.

An engineered shop layout plus good, clean working environment, and supplemented by the best in lighting, Franklin has been able to reach new peaks in production in spite of the difficulties which have been experienced by most everyone in the industry.

The accompanying photograph shows the winding department where coils are laminated, wound, wired and tested. Ample bench space is provided, material flows through the benches to require a minimum of steps, and plenty of good light is supplied by an overhead installation of fluorescent.

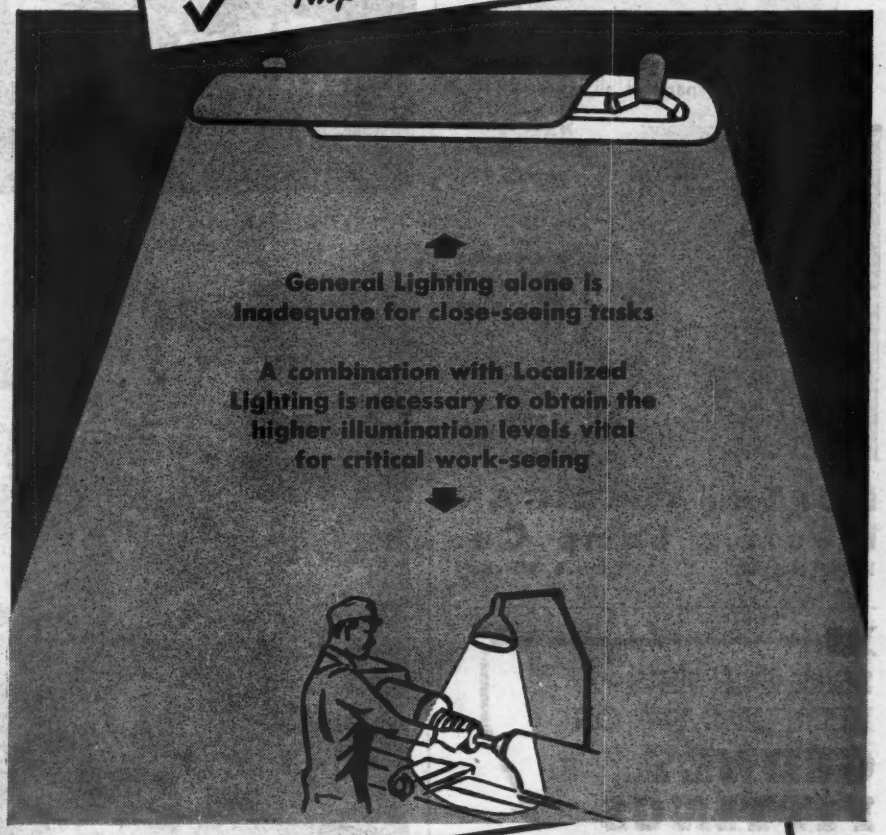
In the varnish and baking room close spacing in inches rather than feet, permits the operator to vacuum impregnate coils and load the bake oven with an absolute minimum of steps. In addition, a conveyor system from several more distant varnish tanks, carry the coils to the bake oven to save steps.

The vacuum impregnating kettles are about 30 inches in diameter, which is large enough to meet the maximum requirements. Racks support the coils into which varnish flows under vacuum conditions of about 28 inches.

Following the initial assembling, winding and testing, the coils go to the baking room where they are preheated in the oven to drive out all excess moisture. They are then placed in the varnish kettle racks and impregnated,

WORKERS DO BETTER WITH "Balanced" Lighting

✓ Increased Production
✓ Better Work Quality
✓ Improved Morale



FOR EXAMPLE — Quick, accurate seeing on a machining operation requires a minimum of 150 f.c. on the critical work-area, balanced with 30 f.c. for the surrounding area — a ratio of 5 to 1. The combination of general lighting of 30 f.c. at work level and localized lighting of 150 f.c. directly on the critical work-area provides the proper efficiency of seeing conditions most economically.

For a fundamental survey of light for "seeing" in your plant, call Fostoria Industrial Service. A study and recommendation by these qualified specialists will offer profitable solution to your lighting problem. There is no obligation for this expert counsel.

BALANCED LIGHTING fostoria
GENERALITES for Overall Lighting • LOCALITES for Light ON the Job
Trade Mark Reg. U S Pat Off

FOSTORIA INDUSTRIAL SERVICE
Factory and General Offices • Fostoria, Ohio
Affiliated Manufacturers—Southern Industries, Inc., Atlanta
Newmac Co., Ltd., San Francisco
Amalgamated Electric Corp., Ltd., Toronto, Canada

A SPECIAL MESSAGE
About Infra-Red Ray Drying

To Those Whose Production Requirements Necessitate the Use of Lacquers, Synthetics, Paints and Other Finishes

Use Nalco Infra-red Ray Drying Equipment to solve a wide variety of problems . . . spot drying and baking of various finishes and dopes . . . quick drying of varnishes and impregnating materials for motor windings and electrical and mechanical parts of all types.



NALCO DRITHERM LAMPS

- Will Cut drying costs and time.
- Eliminate "warm up" time.
- Require no enclosures nor ovens.
- Use a minimum of space.

Left — Nalco 5-light portable adjustable unit.

NORTH AMERICAN
Electric Lamp Co.
1044 Tyler St. St. Louis 6, Missouri

SEND FOR THIS HELPFUL DATA ON
GEDNEY FITTINGS



"Gedney Fittings Fit"
SOLD THROUGH WHOLESALERS

GEDNEY ELECTRIC COMPANY
RKO BUILDING NEW YORK 20, N. Y.



CLOSE SPACING of varnish kettles and baking oven reduces the steps of the operator who vacuum impregnates the coils and then loads them onto the shelves.



MAIN WINDING and wiring room is arranged for smooth flow of material. Ample room and plenty of good illumination encourage efficient production.

followed by a vacuum drain. An initial two hour bake is then given the coils in the oven at 300 degrees F. after which they are cooled, given a fast re-dip and drain, and then a second baking for four hours at 275 degrees Fahrenheit.

A forced draft oven made by the Despatch Oven Company provides the baking chamber with a smooth, rapid flow of air over the coils. A special exhaust removes volatile vapors. Automatic temperature controls keep the heat uniform at any setting within plus or minus one degree Centigrade. This accurate control of temperature permits baking large and small coils simultaneously without danger of under- or over-baking. Following the final baking operation the coils are returned to the test department where complete tests are run on all coils.

DIRECT DRIVE ON COIL WINDER

The story about the leaky plumbing in the plumber's basement is an old, old story, but a reasonable facsimile appeared recently in the coil-winder drive of Reliance Electric and Engineering Company of Cleveland, Ohio. Down-time and the maintenance problem was becoming acute. Troubles were attributed in the main to the variable speed features of the older machines such as friction clutches, belts, shafts, and bearings. So plant engineers decided to improve the design by use of their own manufactured variable speed drive using a direct connection by mounting the winding block on the drive motor shaft.

Preliminary tests indicated that a motor providing a continuous pull of

70 pounds at the outside of an 18-inch coil would be required.

The previous design used a friction clutch for smooth starting and acceleration and for variable speed operation. Wire tension and machine friction gave a fair amount of braking. Speeds as high as 2500 rpm. could be obtained if dynamic balance permitted.

The new design, however, performs these functions better and with less wear and strain of mechanical parts. A rheostat is connected to a foot treadle which the operator uses to start, accelerate and select any desired speed of operation.

As the treadle is depressed the motor tries to rotate and sets up a pull on the wire roll. As the treadle is gradually depressed further, the pull of the motor will finally exceed the back-pull of the roll of wire, and the winding operation begins.

The design of the rheostat is an important factor in this smooth pull-up,



NEW DESIGN provides for mounting the winding head directly to the face plate which is mounted on the motor shaft.

start and accelerated operation. By properly selecting the resistors, the first half of the rheostat gives very little speed increase to the motor. Thus the operator can depress the treadle considerably without increasing the pull too rapidly. Once started, the operator can select any operating speed merely by further depression of the treadle. By this arrangement the only limit to winding speed is the operator's ability to handle the wire.

In order to provide quick and accurate stopping, regenerative and dynamic braking is supplied in addition to an a.c. magnetic brake. Separate foot treadles located alongside the speed-adjusting treadle permit the operator to release the brake and turn the chuck over manually during set-up.

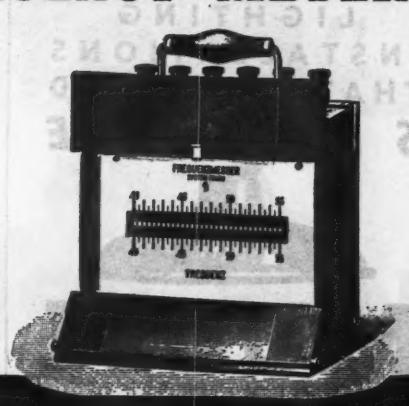
All the auxiliary equipment is mounted under the table so that the

[Continued on page 168]

"FRAHM" FREQUENCY METERS

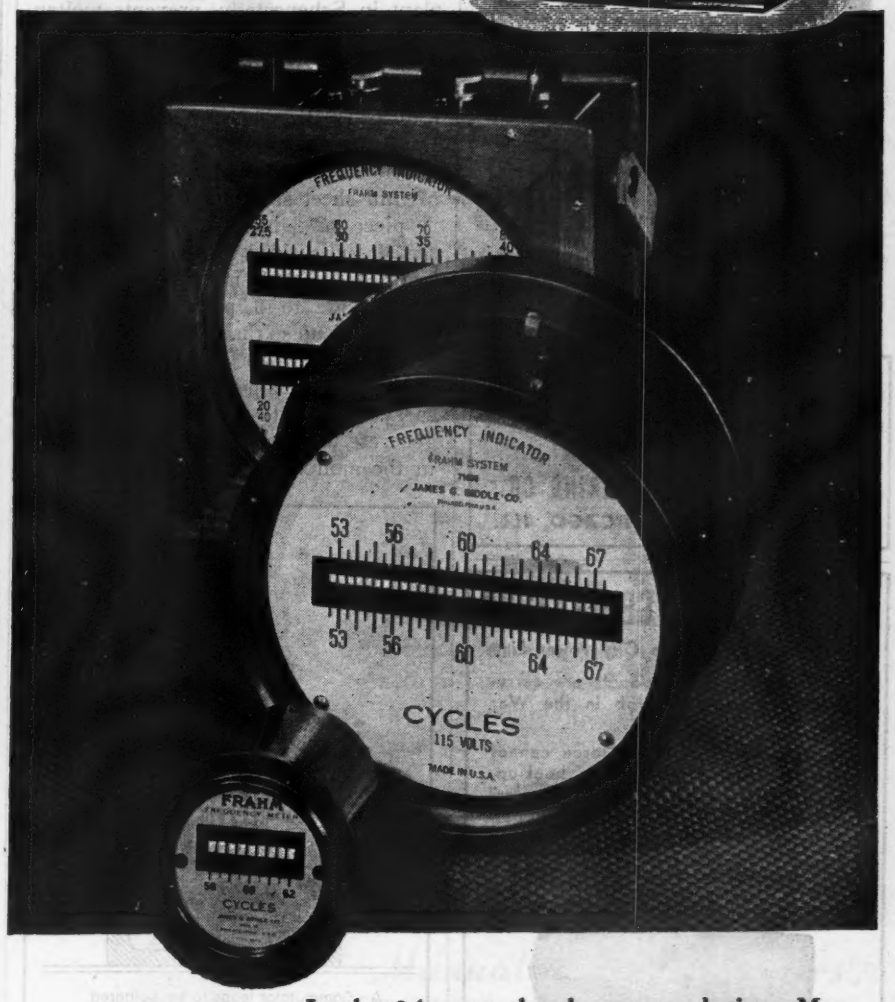
. . . IN 1910

the wood engraving at the right appeared in our first bulletin on Frahm Resonance Frequency Meters.



AND TODAY . . .

the Frahm instruments shown below are typical of the thousands we build each year.



In the 34 years that have passed since Mr. James G. Biddle introduced Resonant Reed Frequency Meters to American industry, the basic principle of these instruments has not changed. Countless refinements and improvements have been made since that date, and the range of application is being constantly broadened. Frahm Resonant Reed Instruments were unique and outstanding in 1910. And today, through Biddle experience, research and development, the same simple resonant reed principle is being applied to the solution of an amazing number of measurement problems.

Write today for Bulletin 1695-EC

James G. Biddle Co.

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

LIGHTING INSTALLATIONS THAT GIVE GOOD SERVICE



MULTI

Reflectors

• No two installations require the same fixtures so contractors rely on MULTI to give them the proper unit for a job. MULTI Reflectors are modern, flexible, and require little or no maintenance for good long-time service. You can guarantee every job on which you use MULTI Units . . . they'll live up to all claims.

• Send for Complete Catalog

MULTI

ELECTRICAL MANUFACTURING CO.

1840 W. 14TH ST., CHICAGO, ILL.

KATOLIGHT A. C. GENERATORS

Furnish Same Current as City Power Lines

Kato Engineering products are carrying out an important job in the War Effort.

A maneuvering fighting force cannot arrange for a power line hook-up. KATOLIGHT GENERATORS furnish electricity on the field of battle which permits equipping our fighting forces with the most modern electrical appliances.



"10 K.W. Revolving Field Generator"

Fighting forces need guns, planes, tanks, trucks, kitchens, emergency hospitals, lights, etc. To keep this equipment going, complete repair equipment such as drills, grinders, saws, air-compressors, etc., are needed. Standard A.C. electricity, the same as you get from the power line, must be had for operating these devices. Portable KATOLIGHT GENERATORS supply this electricity. They also supply current for radio transmitters, beacons, landing field controls, etc.

Available in all standard voltages and sizes up through 25,000 watts. Also manufacturers of rotary converters, frequency changers, motor-generators, gas engine driven battery chargers, high frequency motor-generators, and converters.

KATO ENGINEERING COMPANY

636 No. Front St. Mankato, Minn., U. S. A.

Motor Shops

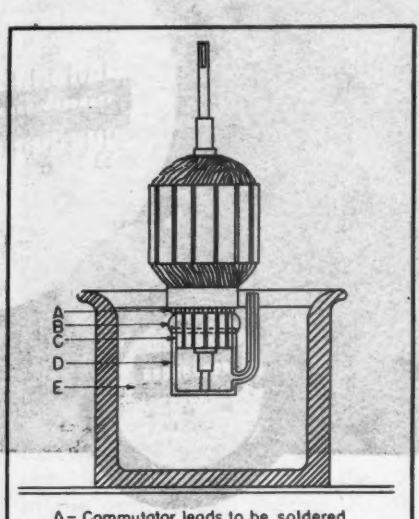
[FROM PAGE 167]

winder can be moved anywhere in the shop. Connection to a.c. power lines are only outside attachments necessary.

PROTECTIVE SLEEVE PREVENTS SPATTER IN DIP-SOLDERING

A simple but effective protective sleeve devised by Donald Butter, a plant engineer at the General Electric plant in Schenectady, prevents molten solder from spattering on the operator or adhering to the body of the commutator or shaft when dip-soldering leads of small generator rotors into the slots of the commutator segments.

The sleeve consists of a cup formed of thin sheet steel with welded joints. A piece of ¼-inch standard pipe inserted and welded into the side of the cup near the bottom extends up along the outside to a point high enough above the cup so that it protrudes above the solder when the commutator is submerged. The pipe acts as a vent to carry off any steam or vapor that may generate when cold metal is submerged in the molten solder.



A – Commutator leads to be soldered
B – Friction Tape Seal
C – Commutator
D – Protecting Sleeve
E – Solder

PROTECTIVE SLEEVE to prevent spatter in dip-soldering.

The cup is made with a slide fit so that it may be assembled on the commutator snugly, but without bending. It covers the shaft end and about three-quarters of the commutator body. The joint between the commutator body and the cup is taped, sealing it to prevent the entrance of molten solder. The entire rotor is suspended in a vertical position, with the commutator down, on an electric hoist directly over the solder pot. The commutator end with sleeve

MINERALLAC

New Practical Unit to Cut Installation Time

• The "Messenger Hanger" and the "Messenger Strap" fill the need for an economical, practical, time-saving unit for use with the new messenger cable type of installation. Mechanically strong, durable, lightweight. They save considerable materials and are easily and quickly installed. Our bulletin gives full and complete details—send for it.

See your Jobber.



"Messenger Hanger" for Conduit and Cable
Strong made of Cadmium Plated Steel or Everdur. Top loop of hanger grips messenger cable to permit conduit to be put in place without falling off.



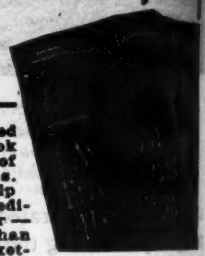
"Messenger Strap" for Outlet Boxes
Of Cadmium Plated Steel or Everdur. For messenger cable installation to be used with Mineralac "Messenger Hanger." Fits all standard outlet boxes and ⅝" messenger cable.

MINERALLAC ELECTRIC COMPANY

New York City Office 50 CHURCH ST.
THEODORE B. DALLY
25 N. Peoria St. Chicago

HOW TO handle every type of electrical job

—quickly
—accurately



Thousands have used this famous handbook as a working guide of everyday usefulness. NOW it is ready to help you too, in a big 5th edition — 800 pages larger — up-to-date — more than ever the one great pocketbook of practical electricity for you.

1800 pages, 1177 illustrations, $5.

Croft's AMERICAN ELECTRICIANS' HANDBOOK

Revised by C. C. Carr, Pratt Institute

This book is packed from cover to cover with the facts every man doing electrical work needs to have constantly at hand—from fundamentals of electricity to remedies for electrical equipment troubles. Helps you install commercial electrical apparatus and materials intelligently, operate electrical equipment efficiently, and maintain it at high operating efficiency.

10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.

Send me Croft's American Electricians' Handbook for 10 days' examination on approval. In 10 days I will send $5.00 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Position .....
Company FEC-9-44

assembled is completely submerged in molten solder, covering the slots and lead ends. The rotor is left in this position until the leads are thoroughly sweat into the slots, then it is hoisted. The sleeve is easily removed with asbestos gloves, and the rotor is placed on a table to cool.

DIP TANK ON WHEELS

The dip tank for varnish impregnation of coil insulation has been built on wheels for a special reason at Walter J. Rider's motor shop in Binghamton, N. Y. The inside dimensions of the tank are 24 inches by 30 inches by 36 inches deep. The bottom of the tank is some 14 inches off the floor,



CASTERS ON DIP TANK make easy rolling to chain falls for handling large armatures and transformer coils. Superstructure of motor-coil dipping assembly does not permit swinging chain falls over tank while in this position. Twelve ball bearings ride the channel-iron guide inside and out for easy raising and lowering.

but to accommodate shafts of large armatures a pipe extension 12 inches long has been put in the center of the bottom.

Large caster wheels have been installed on the dip tank so that it can be rolled under a nearby set of chain falls to handle heavy armatures and transformer coils.

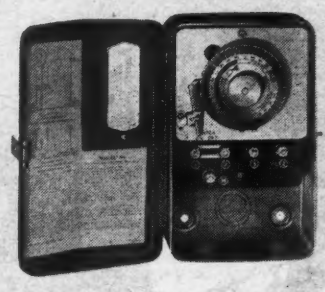
Walter has built a trapeze frame of two inch channel iron to facilitate multiple dipping of motor coils. An angle iron hanger frame is equipped with a total of twelve old ball bearings that ride on the channel-iron guides. The angle frame has 14 hooks for carrying motor coils. The assembly is raised and lowered by pulley blocks for easy handling.



Mr. Tops, the Paragon symbol of quality

"TOPS" AS A GOOD WILL BUILDER

Paragon time switches and industrial timers win friends and satisfy customers. They insure top quality installations. Use them on your next job.



300 Series

Only $13.00 *List*

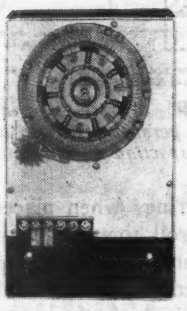
300 Series self-lubricating time switches are accurate and durable for controlling stokers, oil burners, blowers, pumps, valves, air conditioning, etc. America's leading time switch value.



800 Series

Time Delay Relays

The time cycle of Paragon synchronous motor operated, instantaneous reset, type relays is unaffected by vibration or changes in ambient temperature. For motor and tube protection.



700 Series

7-Day Time Switches

. . . are designed for presetting heating or ventilating schedules on a weekly basis with independent daily operations.



2500 Series

Manually Preset Timers

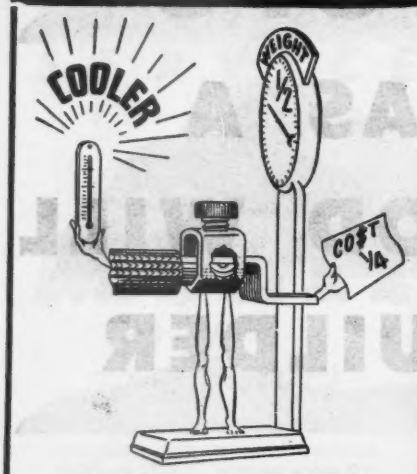
The 2500 series is designed to close or open a circuit at the end of a preset interval, such as attic fan control.

Send for complete bulletin. All these units are designed and built by a pioneer in the automatic timing field.

PARAGON ELECTRIC COMPANY
710 OLD COLONY BUILDING
CHICAGO 5, ILLINOIS

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

ILSCO
Electrical Connectors



PROVED BY TESTS

Recent tests made by a leading switch manufacturer proved that ILSCO 225 amp. SOLDERLESS CONNECTORS ran 12% cooler than a cast connector of another manufacturer whose connectors are *twice as heavy* and cost *four times as much.*

ILSCO CONNECTORS are cooler, lighter, and cheaper because they're built from 100% electrolytic pure copper drawn right in our own plant. Cast connectors, of course, are made of alloy copper with poor conductivity.

Make the tests yourself . . . you'll appreciate ILSCO superiority

ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO

Insto-gas



CUT SOLDERING COSTS up to 50%

Insto-gas Torches and Furnaces actually cut soldering costs down to one-half for electricians. A cylinder of **Insto-gas** lasts at least FIVE times as long as one of compressed gas of about the same size. Other savings result from the clean, non-oxidizing **Insto-gas** flame which leaves no smoke, soot or grease to cause faulty joints. Besides, it lights instantly and won't blow out. Listed by both Underwriter's and Factory Mutuals Laboratories.

Mail this coupon today

INSTO-GAS CORPORATION Detroit 7, Mich.
Please mail me your Insto-Gas Bulletin and tell me how to furnish Priority rating. Send me name of nearest distributor.

NAME .....

ADDRESS .....

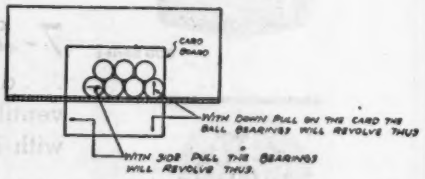
Modern Lighting

[FROM PAGE 112]

To accomplish this, a special rack was constructed on which the bearings were placed. This rack, measuring about 10 inches by 15 inches, rested on a bench in front of a seated inspector and was so built that the plane on which the bearings rested, sloped toward the inspector, and also sloped from his left to right hand. A piece of thin wood about six inches high was placed in a vertical position in front of the inspector and fastened to the approximately horizontal table top.



INSPECTORS RACK showing the inspector utilizing reflected light from vertical wood partition to ease eye fatigue and to more positively identify defective balls.

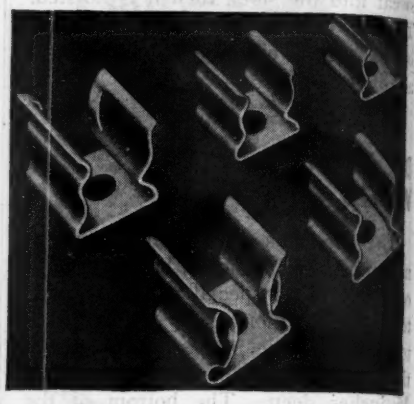


PLAN VIEW of rack showing cardboard which permits inspector to rotate balls for inspection of entire surface.

The ball bearings when placed in the rack would roll toward the inspector until their progress was arrested by coming in contact with the vertical barrier, after which they would then start rolling toward the right. A slot cut in the vertical barrier just above the surface on which the bearings rested permits a sheet of white matte cardboard to be inserted below the bearings and the movement of this cardboard would permit the bearings to revolve, thus permitting the inspection of the entire surface. Both the horizontal and vertical contact surfaces were painted a flat white.

Diffuse lighting on the work was

THE FUSE CLIP IS A VITAL PART OF COMPLETE CIRCUIT PROTECTION



Littelfuse **FUSE CLIPS**

Send for NEW Littelfuse Fuse Clip Bulletin

New Bulletin shows exclusive Littelfuse improvements for greater contact and firmer grip for maximum electrical conduction, lower coefficient of temperatures, protection of panel boards and switches—*with new efficiency factors for complete circuit protection today.*



LITTELFUSE INCORPORATED
200 Ong Street, El Monte, California
4757 Ravenswood Ave., Chicago 40, Illinois

What Makes a Mailing Click?

Advertising men agree . . . the list is more than half the story. McGraw-Hill Mailing Lists, used by leading manufacturers and industrial service organizations, direct your advertising and sales promotional efforts to key purchasing power.

In view of present day difficulties in maintaining your own mailing lists, this efficient personalized service is particularly important in securing the comprehensive market coverage you need and want. Investigate today.

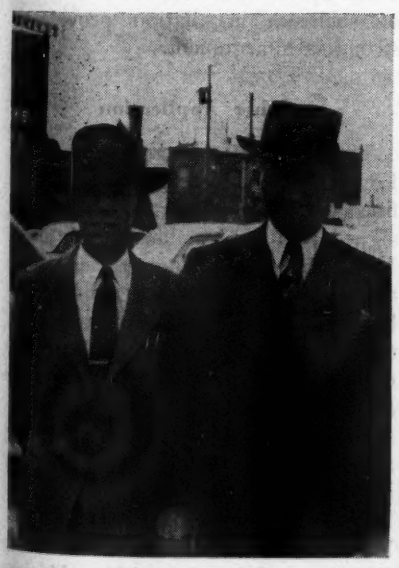


McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street, New York, 18, N. Y.

provided by using the white contact surfaces to reflect the light from a 100-watt incandescent lamp in a flexible-arm machine light. The reflector was placed below the operator's eye level and so adjusted that the light was directed down at approximately 45 degrees with a little more than half of the light falling on the vertical surface and the balance on the horizontal surface. The paint on the vertical surface thus reflected light evenly on the back half of the bearings, or that portion nearest to the inspector. As previously noted, it was in this area of reflected diffuse light that pits, scratches and lack of sufficient plating could be most readily detected with the minimum amount of eye fatigue.

Approximately two to three hundred foot-candles is projected on the vertically reflecting surfaces of the bearings, depending upon the distance of the local lamp, while 50 to 70 foot-candles is reflected down on top of the bearings. General lighting is provided in sufficient quantity so as not to violate a maximum ratio of ten to one brightness contrast between the working area and surrounding visual field. Care also is taken in the selection of source and location of general lighting units to avoid extraneous reflections on the highly polished specular surfaces being inspected.

This lighting data was submitted to the Illuminating Engineering Society by O. M. Collar, Illuminating Engineer, Commonwealth Edison Company, Chicago, Illinois, as a solution to the lighting problem and to aid in the design of similar installations.



MISSOULA, MONTANA had two electrical contractors at the annual Montana Chapter, IAEI meeting at Great Falls, K. G. Curtis, of Missoula Mercantile Co., and O. W. Wolford, Wolford Electric Co. and vice president of the Montana Electrical Contractors Assn.

It Pays in 6 Ways to use J-M TRANSITE DUCTS



1 Light-weight . . . made of asbestos and cement, Johns-Manville Transite Ducts are light and easily handled. Thinner walled Transite Korduct, for use in concrete envelopes, is especially light in weight.

2 Long lengths . . . these ducts are so strong and light that they can be made in longer lengths which save assembly time by requiring fewer joints. And, with Transite Korduct, fewer spacers are needed.

3 Easily assembled couplings . . . The use of tapered sleeve couplings further speeds up installation and assures permanently tight joints.

4 No concrete envelope necessary . . . with Transite Conduit. It's so strong, so rotproof, fireproof, and rustproof that—underground or above ground, it needs no protective concrete casing; and no paint or other preservative treatment.

5 Long, trouble-free life . . . Made of asbestos and cement, two mineral products, Transite Ducts get stronger with the years. Cannot deteriorate.

6 No priorities needed . . . Being non-metallic, Transite Ducts are readily available in quantity for whatever use you may have for them.

JOHNS-MANVILLE

TRANSITE CONDUIT

Designed for exposed work and for use underground without a concrete encasement.

JM PRODUCTS

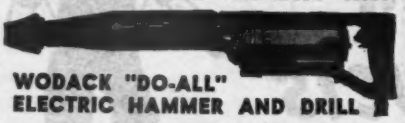
TRANSITE KORDUCT

For use in concrete. Thinner walled, otherwise identical with Transite Conduit.

WHERE TO BUY

Equipment, Materials and Supplies for Electrical Construction—Maintenance—Repairs

DRILL CONCRETE THE EASY WAY



WODACK "DO-ALL" ELECTRIC HAMMER AND DRILL

Saves time and labor installing expansion anchors. Two motions—reciprocal for hammer drilling—rotary for twist drilling. Drills masonry to 1¾" dia., metal ⅝". Easy to maintain. Universal motor, runs direct from lamp socket. Weighs 15 lbs. Star drills in 17 diameters. Also chisels, bull points, etc. Ask for bulletin.

Wodack Electric Tool Corporation
4628 W. Huron St. Chicago 44, Ill.
Telephone AUstin 9566

SWITCHPLATE LAMP



An Ideal Over Door Signal . . .

A real lamp in a switchplate. Mounts on a single-gang box. Ideal for scores of applications where a modest light is adequate. Low current consumption. Perfect for "over door" signal; to mark equipment; for elevator up-down signals; etc. Uses either 3 or 6 watt S6—120 volt tungsten lamp. 2" lens diameter. Colors, red-green-white.

Write for catalog on other types

Sold Nationally by
THE GRAYBAR ELECTRIC CO.
Mfg'd by the H. R. Kirkland Co., Morristown, N. J.

TORK



TURN ANYTHING ELECTRICAL ON & OFF REGULARLY

The TORK CLOCK CO., Inc.
MOUNT VERNON, NEW YORK

for
SAFETY'S SAKE SODER-FLUX
Underwriters' Approved
L. B. ALLEN CO., INC.
6715 Bryn Mawr Ave. Chicago 31, Ill.

A Good Habit . . .

This "Where to Buy" Section supplements other advertising in this magazine. It's a good habit to check this page—every issue.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : BUSINESS : **"OPPORTUNITIES"** : EQUIPMENT : USED OR RESALE

UNDISPLAYED ——RATES—— DISPLAYED

(Not available for equipment advertising)

10 CENTS A WORD. MINIMUM CHARGE $2.00

Positions Wanted (full or part time individual salaried employment only), ½ the above rates payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.

Discount of 10% if full payment is made in advance for 4 consecutive insertions. E.C.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

New advertisements received by Aug. 21 appear in Sept. issue, subject to space limitations.

MANUFACTURERS' AGENTS
WANTED

By old established conduit fitting manufacturer. Opportunity for men who are well acquainted and now traveling the following states: New York, Virginia, Illinois, Missouri, and Indiana. Write

RW-322, Electrical Contracting
520 N. Michigan Ave., Chicago 11, Ill.

FOR SALE

Western Electric Oven

Infra-red ray radiant oven for baking or heat drying parts finished with paint, enamel, lacquer, black wrinkle or polymerin.
Size—Traveling chain conveyor 28' long x 31½" wide x 33" high.
Speed — variable.
Heat — 450° F. maximum. Can be reduced to own requirement.
65000 Watts—440 Volts—Equipped with Hail incandescent lamps.
Equipped with explosion proof motors and switches including all electrically controlled equipment.

ROYAL CROWN
Bottling Company of Newark, Inc.
245 Raymond Boulevard, Newark 5, N. J.

ELECTRIC EQUIPMENT CO.
63 CURLEW ST. • P.O. BOX 51
ROCHESTER 1, NEW YORK



NEW AND REBUILT

ELECTRIC MOTOR WANTED

New or used electric motor. 3 h.p. or 5 h.p. single-phase 60 cycle 110-220 volt 900 or 1200 r.p.m. Electrically reversible type (brush riding). High starting torque for elevator service. Wire or write

Pick Mfg. Co., West Bend, Wisconsin

Motorizing Hand Elevators

[FROM PAGE 39]

of the V-belt sheaves on the motor and jack-shaft can be determined. With the weight of the maximum load known (cage weight is balanced by counterweights) and the rate of lift determined from the rope wheel rpm., the gear ratio between the rope wheel shaft and cable drum shaft, and the diameter of the cable drum, the required horsepower of the driving motor can easily be determined. From then on, it is merely a problem of designing the control circuits which can be readily arranged to meet any special requirements of each job, and making the installation.

Cost

The average cost of elevator electrification, similar to the installation described, runs approximately $600 including engineering, furnishing and installing the necessary equipment. Installation of service to the motor control switches is additional. This cost, of course, will vary depending upon the number of floors the elevator serves, the size of motor and equipment installed and the accessibility of space for mounting the motor and V-belt drive. However, the labor saving feature and the speed-up in materials handling that an electric drive affords, more than pays for the investment in a short period of time. The economics of such an installation provides a strong sales argument.

Other Application

The rehabilitation activities of the Loyd Electric Company are not confined to elevator work. Loyd has designed, sold and installed electric motor V-belt drives on numerous hand operated bridge cranes and hoists. He has also helped the conveyor people out of a hole by supplying them with electric conveyor drives consisting of a rebuilt reduction gear box with sprocket and V-belt motor drive sold as a packaged unit. This activity alone has brought him, since Pearl Harbor, upward of $50,000 worth of business from the states of Texas, Oklahoma, Colorado and New Mexico.

Such diversification of activities is the profitable outcome of one of Mr. Loyd's pet hobbies—a natural desire to design and build things to solve perplexing problems.

Estimating Conduit Work—Part II

[FROM PAGE 52]

against 12 ft. Table II indicates the percentage which should be added to the base labor units for height variances. A good rule is to add five percent additional for every foot over 12 feet. This additional cost contemplates the use of ladders. Although the use of scaffolds involves a non-productive factor in pushing, a saving in labor is normally reflected on higher installations.

Table II, concerned with the use of ladders, is based on two governing factors: (1) The additional time spent in lifting materials and walking up the ladders as the height increases and (2) The additional time spent in moving the larger ladders.

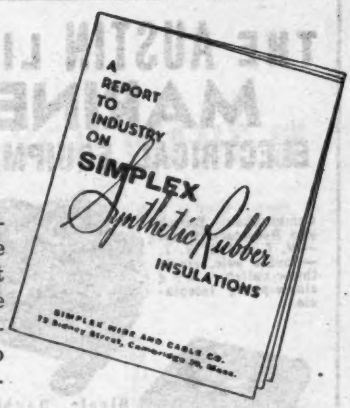
Above 20 feet scaffolds are normally used for volume work. It is often desirable on any heights from 12 ft. up to use rolling type scaffolds, but each case must be weighed on its own merit. The amount of non-productive labor required to push the scaffolds should be determined. Often mechanics who push scaffolds can do such productive work as wiring fixtures, passing up materials, etc., or can push several scaffolds. The larger type scaffolds (30 ft. to 40 ft.) require as many as four men to move them while only one or two mechanics are working "top-side".

The height additions in Table II do not apply to the use of scaffolds. Since materials can be lifted to the scaffold deck very easily, non-productive labor of mechanics working "top-side" is negligible. The problem illustrated in Fig. 1 is typical of what estimators encounter.

When using rolling scaffolds, it is important to keep the non-productive work of the "ground" crew to an absolute minimum by coordinating the work schedule so they can be doing productive chores while waiting to supply the "top-side" mechanics or move the scaffolds. Otherwise, the use of scaffolds can become relatively costly.

The labor units which are based on the conditions set forth, in this and the previous article, are relatively in proportion. With a human element injected into the picture, and with an experience differential existing between mechanics or between contractors, it may well be that an electrical estimator may find that the units are slightly higher or lower than his particular labor supply warrants. In such case a general overall percentage increase or decrease can be applied.

MAY WE *Share* WITH YOU WHAT WE HAVE LEARNED ABOUT SYNTHETIC RUBBER INSULATION



After approximately sixty years devoted exclusively to making insulated wires and cables, the skill that enables us to obtain the greatest values from new insulating materials has become second nature. That is why we so quickly developed new synthetic insulations and sheaths to replace special purpose, natural rubber compounds that have been used on Simplex wires and cables so many years.

The change-over is now practically complete and various Simplex wires and cables that have been so favorably known now have synthetic rubber insulations and sheaths to replace the natural rubber compounds formerly used. Laboratory and service reports indicate that Simplex wires and cables as made today may be relied upon for the same satisfactory performance as in the past.

Because of the wide interest in the new materials we have collected the results of the work done by our chemical and electrical engineering laboratories in a booklet entitled "A Report to Industry on Simplex Synthetic Rubber Insulations." It is now being printed and we would like to send a copy to you as soon as it is off the press. Please ask for it by post card or letter to the Simplex representative nearest you or direct to us at Cambridge.

Simplex WIRES and CABLES
Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.



DON'T GUESS!—TEST R.P.M.
With a MODEL J
HAND TACHOMETER
Triple Range: 300— 1200 RPM; 1000— 4000 RPM; 3000—12000 RPM
Rugged • Reliable • Continuously Indicating Type
WRITE FOR BULLETIN #760
HERMAN H. Sticht COMPANY, INC.
27 PARK PLACE NEW YORK, N. Y.

CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York, 18, N. Y.
Director of Circulation:
Please change my address on Electrical Contracting
From .....
.....
To .....
.....
Signed .....

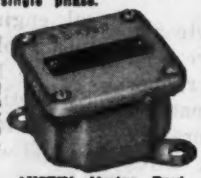
THE AUSTIN LINE
MARINE
ELECTRICAL EQUIPMENT



Combination Switch and Receptacle Boxes—W. T. and N. W. T.—double pole, single throw-switch, and single-phase receptacle.

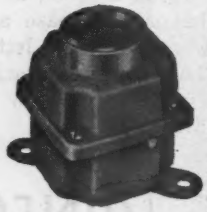


Single, Double, and Triple Receptacle Boxes—W. T. and N. W. T.—single phase.



Branch Boxes—W. T. and N. W. T.—have no fuses and are used to connect branch circuits. Branch Junction Boxes are fusable.

AUSTIN Marine Products, some of which are shown here, are made to the highest engineering standards, carefully inspected and packed, and fully approved by the U. S. Navy. Send for Marine Catalog No. 9-S-2 for complete details on the AUSTIN line.



Lamp Type Indicator Boxes — Watertight. Furnished complete with clear green, red, blue, yellow and opal lens.

THE M. B. AUSTIN COMPANY
108-116 S. DESPLAINES ST., CHICAGO.

ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
FROM STOCK

RMC



Soldering Lug



3-Conductor Angle Pothead



Single Conductor Pothead

Write for a complete selection of RUSGREEN bulletins

UNDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

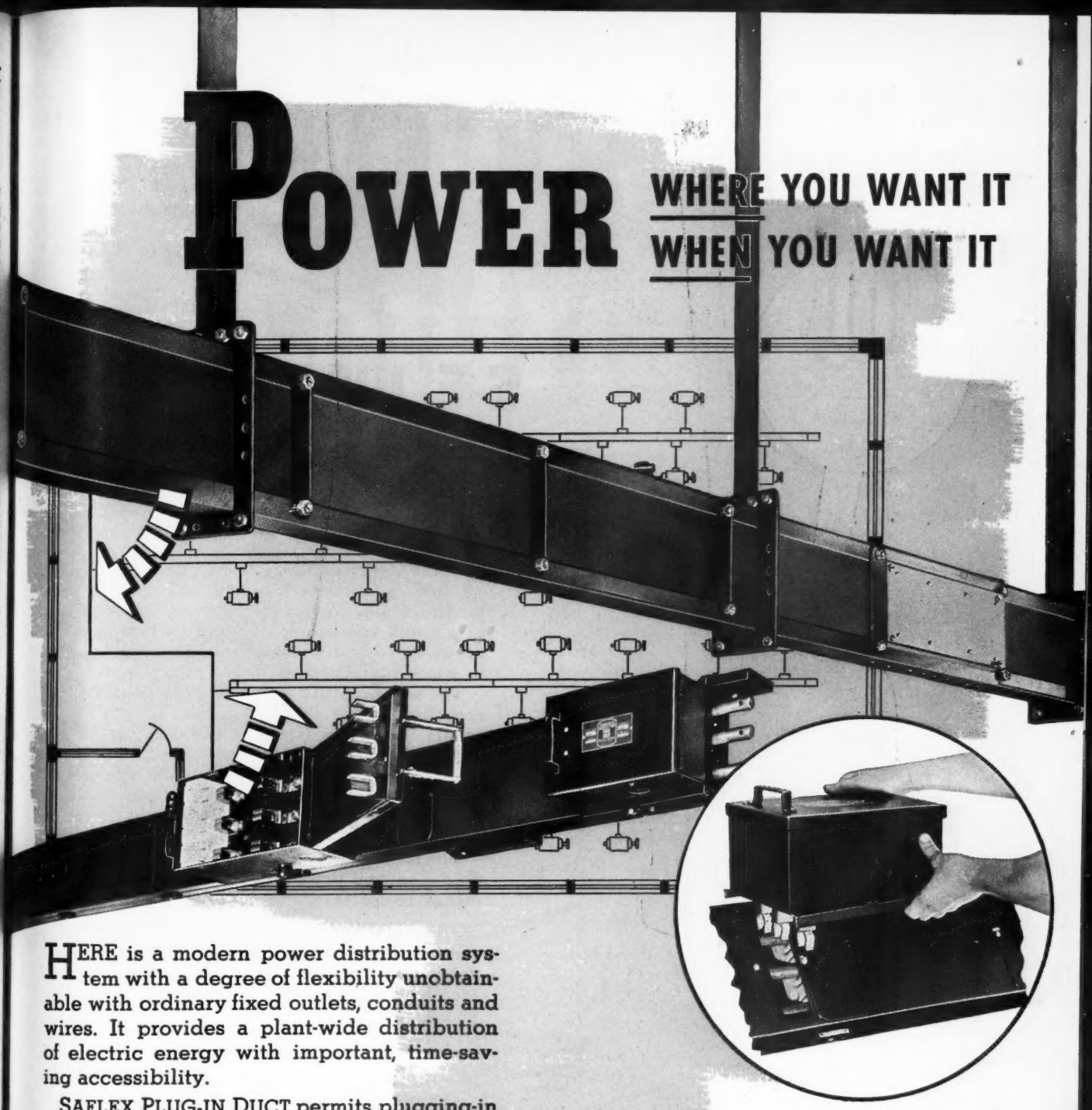
Alphabetical Index to Advertisers

September, 1944

*Adam Electric Co., Frank..... 23
*Aerovox Corporation 78
*Allen-Bradley Co. 101, 102
*Allen Co., L. B..... 172
*Allis-Chalmers Mfg. Co..... 5, 7
*All-Steel-Equipment Co. 20
Aluminum Co. of America..... 131
*American Blower Corp..... 32
*American Transformer Co..... 17
*Anaconda Wire & Cable Co..... 40
*Appleton Electric Co..... 2
Arrow-Hart & Hegeman Elec. Co... 119
*Austin Co., M. B..... 174
*Beaver Pipe Tools, Inc..... 97
Bell Sound Systems, Inc..... 162
*Benjamin Elec. Mfg. Co..... 80
*Biddle Co., James G..... 167
Blackhawk Mfg. Co..... 98
Brach Mfg. Corp., L. S..... 164
*Briegel Method Tool Co..... 99
*Bull Dog Electric Products Co.... 79
Century Electric Co..... 85
*Champion Lamp Works..... 144
*Collyer Ins. Wire Co..... 27
Corning Glass Works..... 107
Crescent Ins. Wire & Cable Co..... 103
Crouse-Hinds Co. 73
*Curtis Lighting, Inc..... 33
Cutler-Hammer, Inc. 72
*DayBrite Lighting, Inc..... 105
*Efficiency Elec. & Mfg. Co..... 95
Electric Equipment Co..... 172
Electrical Buyers Reference..... 162
Emerson Elec. Mfg. Co..... 77
Employment 172
Faraday Elec. Corp..... 24
Fostoria Pressed Steel Co..... 165
Frink Corp. 8
*Fullman Mfg. Co..... 149
*Gedney Electric Co..... 166
General Cable Corp.....34, 35
*General Electric Co. (Bridgeport) Back Cover, 147, 161
*General Electric Co. (Nela Park) 90, 91
*General Electric Co. (Schenectady) Inside Front Cover, 11, 13
Goodrich Electric Co..... 155
*Graybar Electric Co..... 42
*Greenlee Tool Co..... 153
*Hazard Ins. Wire Works Div....25, 36
*Hullhorst Micro Tool Co. (Div. of Toledo Standard Comm. Co.)... 76
*Ideal Commutator Dresser Co..... 16
*Ilg Electric Vent. Co..... 139
*Illinois Electric Porcelain Co....18, 159
*Ilsco Copper Tube & Products Co. 170
Independent Pneumatic Tool Co... 22
Insto-Gas Corp. 170
*Insulation and Wires, Inc..... 94
*Irvington Varnish & Ins. Co..... 75
Jacksonville Metal Mfg. Co..... 150
*Jefferson Electric Co..... 117
Jenkins Brothers 15
*Johns-Manville 171
*Johnson Bronze Co..... 95
*Kato Engineering Co..... 168
*Killark Elec. Mfg. Co..... 9
Kinney Elec'l. Mfg. Co..... 142
Kirk & Blum..... 133
Kirkland Co., H. R..... 172
*Klein & Sons, Mathias..... 146
Kondu Corp. 132
Leader Elec. Mfg. Corp..... 135
*Lighting Products, Inc..... 29
Littelfuse, Inc. 170
Lloyd Products Co..... 145
Masonite Corp. 26
Master Electric Co..... 87
Master Vibrator Co..... 152
*McGill Mfg. Co..... 110
McGraw-Hill Book Co.....158, 164, 168
*Mercoid Corp. 94
*Metropolitan Device Corp..... 1
Miller Co. 113
*Minerallac Electric Co..... 168
Mitchell Mfg. Co..... 111
Monarch Fuse Co..... 151
*Monitor Controller Co..... 69
Multi Electric Mfg. Co..... 168
*M & W Electric Mfg. Co..... 100
National Electric Products Corp... 100
*North American Electric Lamp Co. 166
*Okonite Co. 25, 26
*Onan & Sons, D. W..... 156
*Owens-Corning Fiberglas Corp..... 14
*O.Z. Electrical Mfg. Co..... 157
*Paine Company, The..... 100
Paragon Electric Co..... 169
Paranite Wire & Cable Co..... 125
Pass & Seymour, Inc..... 116
*Penn-Union Elec. Corp..... 136
Pick Mfg. Co..... 172
Pittsburgh Reflector Co..... 112
Porcelain Group 18
*Porcelain Products, Inc.....18, 163
Pryne & Co..... 118
Pyle-National Co., The..... 98
Quadrangle Mfg. Co..... 148
*Radio Corp. of America..... 127
Reading Electric Co., Inc..... 152
*Reliance Automatic Lighting, Inc. 150
*Revere Elec. Mfg. Co..... 156
*Ridge Tool Co..... 28
Rittenhouse Co., A. E..... 30
*RLM Standards Inst., Inc..... 121
Robertson Co., H. H..... 6
*Rusgreen Mfg. Co..... 174
Russell & Stoll Co..... 120
*Sangamo Electric Co..... 12
Searchlight Section 172
Simplex Wire & Cable Co..... 173
*Sola Electric Co..... 129
*Spang-Chalfant 137
Specialty Porcelain Works..... 18
Square D Company..Inside Back Cover
Sterling Varnish Company..... 89
*Sticht Co., Herman H..... 173
*Superior Carbon Prod. Co., Inc... 99
*Sylvania Electric Products, Inc.... 67
*Syntron Company 164
Tal's Prestal Bender, Inc..... 158
Thomas & Betts..... 10
*Toledo Pipe Threading Mach. Co. 37
*Tork Clock Co..... 172
Trico Fuse Mfg. Co..... 97
*Trumbull Electric Mfg. Co..... 115
Union Insulating Co..... 154
*United States Rubber Co.....71, 141
United States Treasury Dept..... 38
Universal Clay Products Co..... 18
Wagner Electric Corp..... 93
Walker Brothers, Inc..... 19
*Ward Leonard Elec. Co..... 154
Ware Brothers, Inc..... 96
*Westinghouse Elec. & Mfg. Co. (East Pittsburgh) 21
*Westinghouse Elec. & Mfg. Co. (Lamp Div.) 108, 109
*Westinghouse Elec. & Mfg. Co. (Lighting Div.) 39
*Wheeler Reflector Co..... 106
Where To Buy..... 172
*Wiremold Co. 31
Wodack Elec. Tool Corp..... 172
Youngstown Sheet & Tube Co..... 4

★ **These companies have included Brieflogs, containing additional buying information on their products, in the 1944 edition of the Electrical Buyers' Reference.**

POWER WHERE YOU WANT IT WHEN YOU WANT IT



HERE is a modern power distribution system with a degree of flexibility unobtainable with ordinary fixed outlets, conduits and wires. It provides a plant-wide distribution of electric energy with important, time-saving accessibility.

SAFLEX PLUG-IN DUCT permits plugging-in for power service anywhere in the plant. It enables you to add new machines, or rearrange present equipment without the usual major operation on the wiring system. Put a machine where you want it. Your power is available on a moment's notice.

SAFLEX FEEDER DUCT serves as a feeder bus for the branch circuits of Saflex Plug-in Duct, or any other service where a heavy current feeder is needed. Because it has convenient tap connections at frequent intervals throughout its length, it serves as a perfect backbone from which to build complete distribution systems for resistance welder installations.

Call in a Square D Field Engineer

Now is the time to bring your wiring system up to date for the highly competitive future. Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan, for Bulletin 6000. Or let a Square D field engineer help you plan for greater efficiency in electrical power distribution.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES



NEW

G-E WEATHERPROOF SOCKETS

THIS sturdy socket with 6-in. leads is ideal for use in industrial plants, steel mills, shipyards, railroad construction, mines, etc. It is made of a tough compound . . . will withstand severe blows . . . has a weatherproof seal around lead-in wires and screw shell.

The weatherproof seal is made by pouring heat-resisting wax in a liquid state in the top of the socket. This wax (see cutaway diagram) covers the whole top of the screw shell and lead-in wire assembly; and it also fills the space between the screw shell and the socket body. This prevents water from seeping into the socket from the top.

The lasting qualities of the socket enable it to be used a second time, too. The length of the leads makes re-use easy.

FOR FURTHER INFORMATION about G-E weatherproof sockets, other wiring devices or conduits or wires and cables, see the nearest G-E Merchandise Distributor or write to Section CDW-941-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

BUY WAR BONDS AND KEEP THEM

ON ADEQUATE WIRING

S. J. O'Brien, electrical contractor, member of the National Adequate Wiring Bureau's executive committee says, "Full adequacy of wiring is the building industry's provable answer to the challenge of the coming wave of new home buyers."

ADEQUATE WIRING — SERVES AND SAVES — THE KEY TO THE HOME OF TOMORROW

GENERAL ELECTRIC

G-E CONDUITS AND BUILDING WIRES

There are G-E conduits and building wires for every purpose: G-E White and G-E Black rigid conduits, EMT, flexible metal conduit, Fiberduct and various building wires including Type SN and Type SNW thermoplastic insulated, small diameter Flamenol* Building Wire.

*Reg. U.S. Pat. Off.

